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Getting the Most Out of Your Machine Tool Dollar

By L. C. Morrow

Managing Editor, *American Machinist*

An expression of the equipment policies of the International Harvester Co., as obtained by interviews with John G. Wood, General Works Manager, and Robert R. Keith, Chief Engineer, Motor Trucks and Buses

WITH the International Harvester Co. the purchase or failure to purchase of replacement and additional machines is altogether a matter of economical production. We do not differ from other manufacturers when we see an opportunity to reduce shop costs. The problem of what and when to purchase is not so difficult of solution as it might seem, because almost always there is a definite answer resulting from the application of relatively simple mathematics.

Additions to equipment are made because they are needed. If we have orders for more of our product than we can make with existing equipment, and we think that we see a continuance of orders on the higher level, we have the choice of letting the business go or adding to our equipment. That certainly is not a difficult problem.

When it comes to replacing serviceable machines by machines of later design and greater productivity, the mathematics becomes more complicated because of the introduction of additional variables. Consideration must be given to the usual costs — tearing out, installation, additional power consumption, delay to production, and so on. Also we must know how long it is going to take for the new machine to pay for itself. Then we must decide upon a definite disposition of our old machine, because we are firm adherents to the policy of getting the most out of our machine tool dollar. The old machine must be moved to a position of usefulness somewhere in one of our plants, or sold, or broken up. We do not let a machine go until its productive usefulness to us is over. This does not mean that a machine must have become actually decrepit before we will dispose of it outside of our plants. Machines comparatively new may be replaced by others of better design and greater productivity even though we have no further use for the machine taken out and must dispose of it well below its cost.

Nor do we set a rigid limit to the time during which a replacement machine must pay for itself. Two years is considered a favorable period and a time as long as five years is likely to be frowned upon. But there is no iron-clad rule, as witnessed by some recent appropriations for replacement machines that are not likely to pay for themselves under four years.

There are two policies that can be followed in using machine tools on "production" work: (1) The machines can be worked to the limit of their capacity with the consequent higher maintenance cost, or (2) They can be kept well within their limit and the maintenance cost thereby held low.

The policy of crowding the machines can as a rule be followed up to the finishing cut, where a sizing operation becomes necessary. Incidentally, this policy serves to bring out the defects of machine tools. When the second policy is followed the work can usually be completed without a special finishing operation.

In our plants we have had the opportunity of observing both methods and our tendency is to favor the policy of crowding the machine to a reasonable maximum capacity, because of the rapidity with which machinery becomes obsolete.

As machines thus crowded become worn we must decide whether to move them to other work, sell them, scrap them, or rebuild them. In doing so we must consider the expense of repairs, the machines available on the market (from the viewpoint of design) and the performance of the worn machine when it was in good

> WITH each step in improved design the user of machine tools is given opportunity to obtain more value per dollar invested and contribution has been made toward the elimination of waste in industry. Our whole economic fabric is woven about production without waste, either of time or material, and in our efforts to improve machine tools all of us are working toward that end, let it be called selfish or unselfish, according to the point of view.

shape. As a result of our experiences, rebuilding is finding more favor with us. One influence is the opportunity given for profitable employment of our men during slack times. When parts of our plants are idle, we follow a very definite plan of repairing equipment.

Our methods of weeding out machines that do not measure up to our standards of service are simple. The superintendents of the individual plants are responsible for maintaining and replacing the equipment in their plants. They keep informed of the development of machine tools by visits to outside plants, by visits to other Harvester plants, by reading the publications devoted to the machinery industries, through advertisements and from their contact with salesmen. They ask for equipment as they need it.

Approving Appropriations

All of the requests and recommendations of the superintendents are sent to their plant managers, of which there is one for each group of three or four plants. The plant managers, when they have approved the recommendations, pass them on to the general works manager, by whom all appropriations for expenditures for equipment must be signed.

Reporting to the general works manager is an equipment engineer, who is acquainted with the equipment of all of the plants. It is his duty to give consideration to all of the recommendations from all of the plants and to prepare for the general works manager statements showing the values of the proposed investments and the reasons for changes and additions as given by the plant superintendents.

Everything pertaining to change of equipment passes through the hands of this equipment engineer. His office is a clearing house and he it is who is in position to know whether a request for equipment can be filled from machines already owned or must be filled by purchase. His records contain the specifications of all of the equipment to be disposed of by all of the plants, and that in storage. His recommendations, then, may take the form of

(1) An O.K. of the superintendent's request.
(2) A refusal of the request.
(3) A proposal to supply the equipment from some other plant.
(4) A proposal to supply it from storage.

Final action is taken by the general works manager.

Influence of Cost of Repairs

A factor disproportionately large in its influence on the value of the dollar spent for equipment is the cost of repairs. Parts obtained from the machine tool builders are followed by invoices that are by no means low. Then frequently we are obliged to fit the parts, even to the inclusion of machine work. We are gradually being influenced toward the position where we will make rather than buy practically all of our repair parts, not because of high prices alone, but also because we can many times increase the life of the part by making it differently, for example of steel instead of cast iron, or hardened instead of soft.

It has been stated in this article that machine tools become obsolete rapidly. And so they do. But, as users, we think that we are in position to point out that there remain many directions in which design may be improved to delay obsolescence.

There are loose-pulley bearings, for example. On much of our equipment we are replacing the old type of bearing by a type with an inserted ball-bearing sleeve. The chief saving comes through the reduction in the number of oilers. In one of our plants, by this change, we have reduced the oiling force by five men.

Bearings give trouble in other ways. Too often they are not equal to the job because they are too small. It appears to us that they are designed without enough regard to the added load placed upon them by cutters that have become dull. It is our feeling that more attention could be given to the table bearings and the knee slides of milling machines. The devices used to lock slides and tables by means of pressure exerted between their bearing surfaces should really lock—and many times they do not.

Other improvements in design would provide heavier tables on drilling machines and more adequate arms to support them; a mechanical method of moving the arms of radial drills, especially when the drill is almost, but not quite, over the bushing; fly-wheels to absorb shock; and more simple and efficient oiling systems.

Flexible mounting of driving pulleys would be an improvement. Machines provided with flexible mountings would fit into line manufacture whether they were to be set parallel to the line or at a right angle. Under present design we are limited by the fixed position of the driving pulley.

Hills and Hollows in the Line

It seems that something could be done in regard to the height of tables. There is no uniformity now, and when the height is not adjustable we must arrange the level of the foundations to bring the tables on a level with the line or must put up with hills and hollows.

The study of the action of tools upon cast iron would prove profitable, especially in boring, if the data obtained were translated into better design, especially as concerns bearings. Cast iron is prone to cause chatter, probably because the chips are broken off rather than cut. A knowledge of the causes of chatter would bring about much needed improvement in design.

Designers Deserve Praise

The trend of design in machine tools has been away from machines fit for the jobbing shop to machines adapted for quantity production work and it has been only natural that the process has been largely one of evolution. Nevertheless the evolution has been rapid, and to get an actual picture of the progress that has been made it is necessary only to observe side by side machines of the same maker put into service, some recently and some several years ago. The older machines are so far surpassed by the newer that designers may justly be proud.

With each step in improved design the user of machine tools is given opportunity to obtain more value per dollar invested and contribution has been made toward the elimination of waste in industry. Our whole economic fabric is woven about production without waste, either of time or material, and in our efforts to improve machine tools all of us are working toward that end, let it be called selfish or unselfish, according to the point of view.

[The preceding article is the fourth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article, by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409. The second, by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719. Other articles on the same subject will be published in forthcoming issues.]

Automotive Production

Manufacturing Hydraulic Four-Wheel Brake Parts

By John Younger
Associate Editor, *American Machinist*

Design and operation of hydraulic brakes—Operations on the master cylinder and wheel cylinders—Inspection —Running-in on a special "road-testing" machine

ONLY three times in the history of the automobile industry has an idea taken hold of the public almost over night and led to a universal demand. The first was at the introduction of the self-starter, the second when balloon tires seized the popular fancy and the third when, because of traffic safety demands, four-wheel brakes appeared on most specification sheets. Today, except in some of the smaller cars, four-wheel brakes are demanded as a standard, and although there are many types the hydraulic type is becoming increasingly popular as, for example on the Chrysler car. The Maxwell-Chrysler Corporation manufactures its own hydraulic brake mechanism.

In the hydraulic brake the depressing of the pedal actuates a plunger in a master cylinder, creating a pressure that is conveyed through a hydraulic line to cylinders and pistons at the brake bands. The thrust of the piston on the band actuates the brake-shoe levers directly. The fluid used is usually a mixture of glycerine and alcohol, though other liquids can be used.

The master cylinder is shown in Fig. 1. Attention is directed to the trunnioning of the piston or connecting rod. The diameter of the cylinder is about 1⅛ in. In the wheel cylinder, shown in Fig. 2, the two pistons act directly on the levers of the brake bands. The cylinder diameter is about 1½ in. Fig. 3 shows the arrangement on a chassis and it will be seen how simple the layout is. The black circular part above the steering gear box is the reservoir for keeping the line full. The majority of the tubing is copper, but the leads to the wheels are metal hose, covered with heavy folds of rubber.

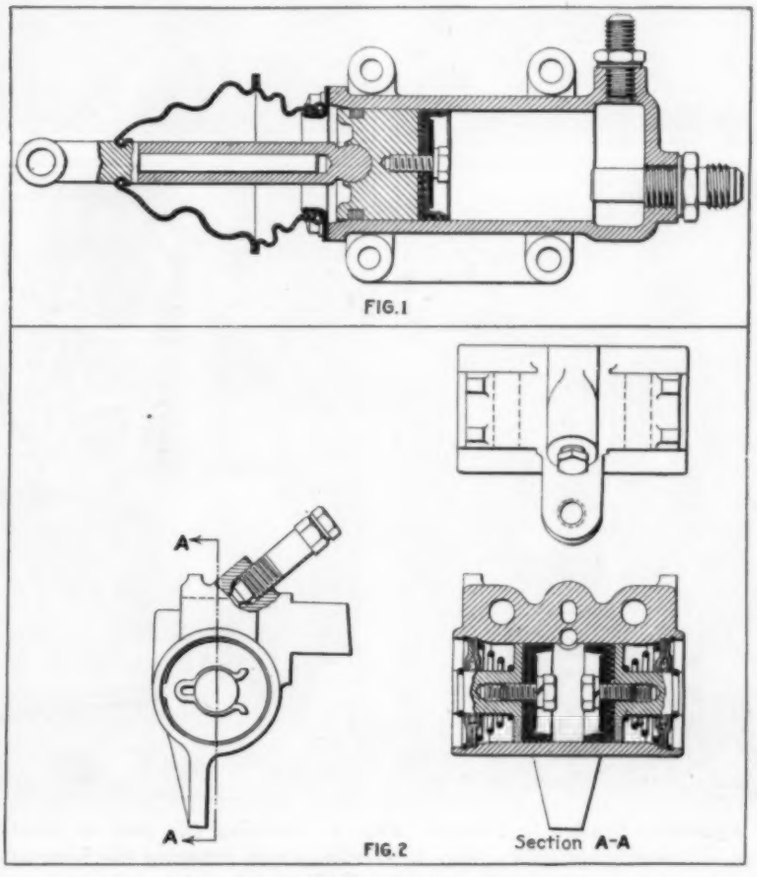
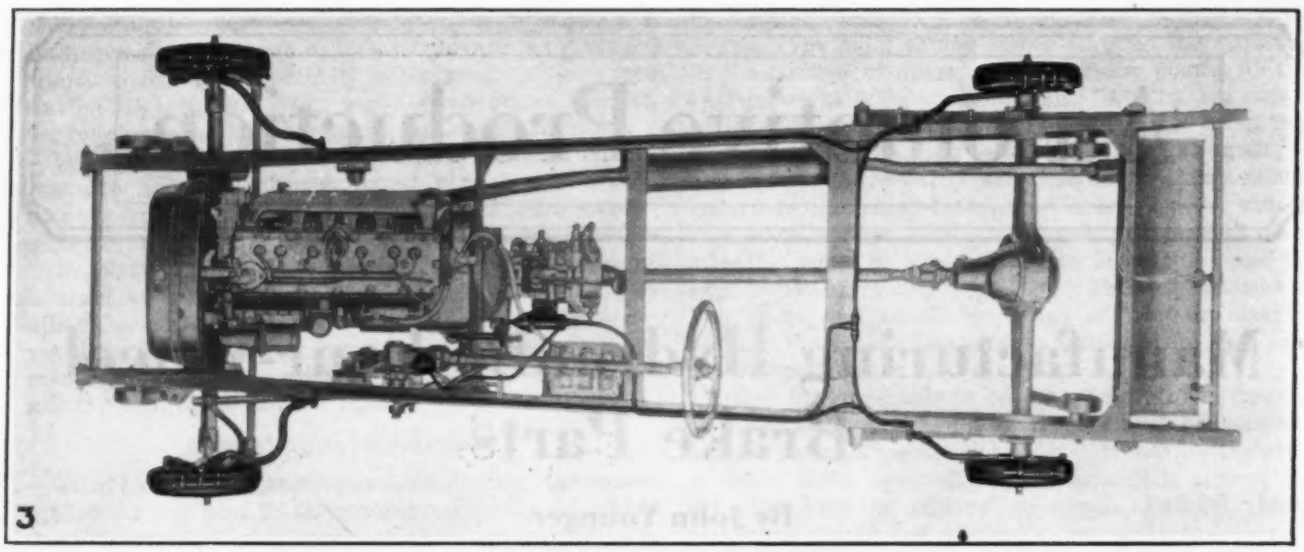
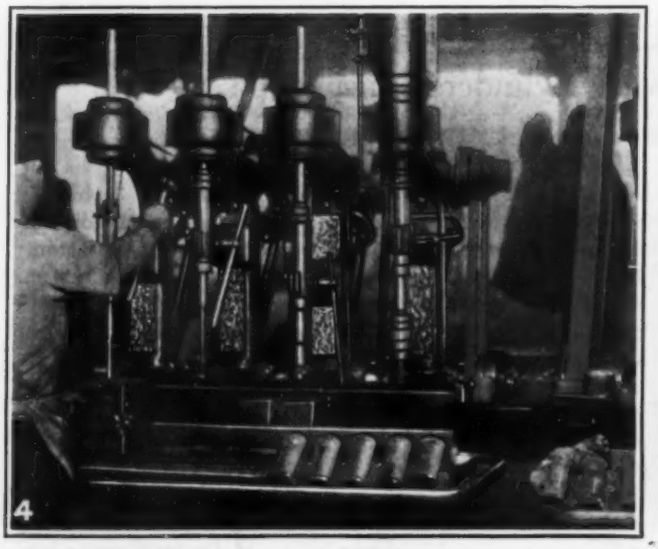
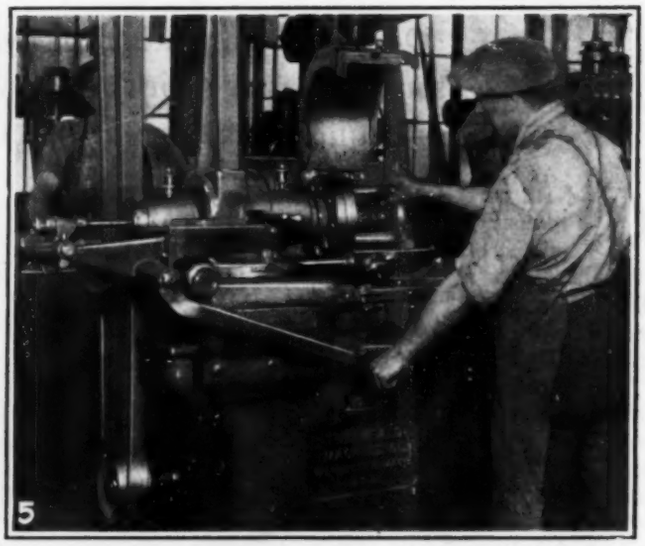


Fig. 1—Master cylinder. Fig. 2—Wheel cylinder

The master cylinder is of cast iron, and the first operation in machining is to mill the large pad in a No. 2-B Milwaukee milling machine. Then the four holes in the pad are drilled and spotfaced in a Leland-Gifford four-spindle machine, Fig. 4, and the two tapped holes for the pipe lines are finished in similar machines. The cored hole above is then drilled, bored, reamed and chamfered and the flange is faced in a Warner & Swasey No. 4 turret lathe. The bore is ground on a







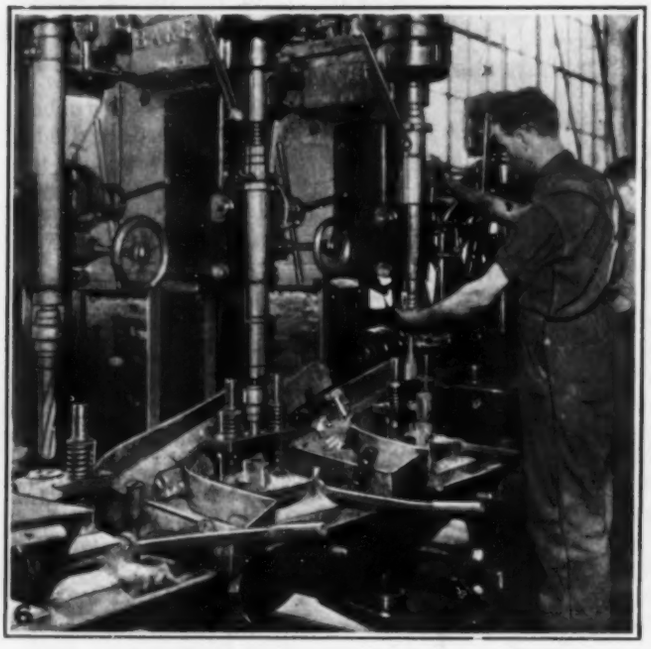


Fig. 3—Application of hydraulic brakes to chassis. Fig. 4—Drilling the pad of master cylinder. Fig. 5—Grinding the bore of master cylinder. Fig. 6—Drilling and reaming the bore of wheel cylinder. Fig. 7—Counterboring the wheel cylinder, and cutting ring grooves

AUTOMOTIVE PRODUCTION

Heald grinder, Fig. 5, and polished in a speed lathe.

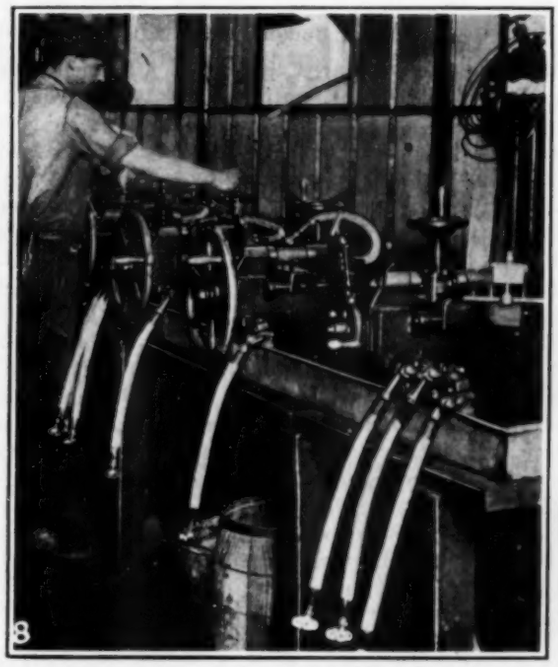
The wheel cylinder is machined differently. After drilling and tapping the ¼-in. pipe-tap holes in a 3-spindle Leland-Gifford machine, the large hole or cylinder bore is drilled and reamed in a No. 121 Baker drill press, Fig. 6. In this operation chutes convey the work from one machine to another.

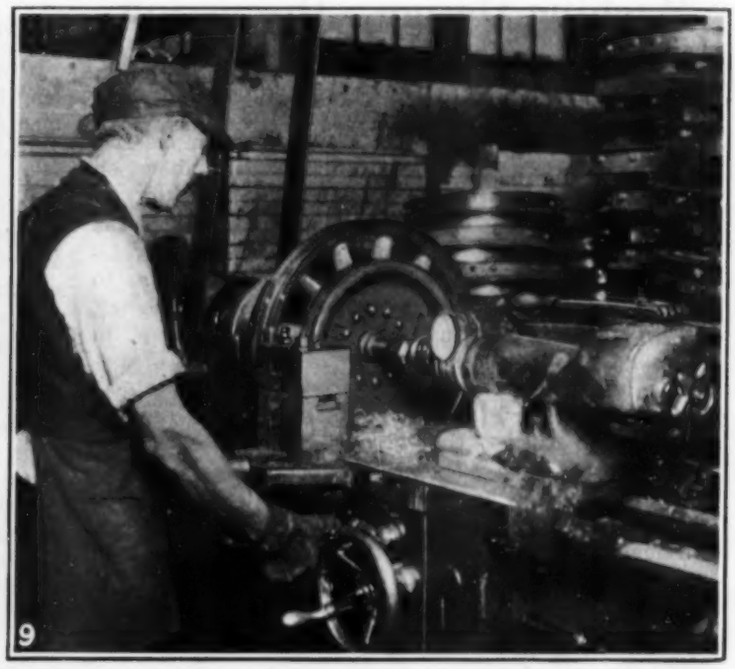
The drilling and reaming operations in the cylinder bore are followed by drilling and facing operations on the bolt holes, milling operations in Cincinnati machines on the lugs, and the counterboring of the bore and the cutting of the ring grooves in a No. 121 Baker drill press as shown in Fig. 7. The bore is then ground as shown in Fig. 4 and polished on the speed lathe, thus completing the piece.

Pistons and other parts are made on automatic screw machines; the "cup leather" is of a special composition of hard rubber.

The inspection test is shown in Fig. 8, where the cylinders and lines are tested at 800 pounds.

A factor contributing to the successful continuous functioning of the brake lies in the machining of the brake drums when secured to the wheel. One detail shown in the illustration Fig. 9, is the insertion of a heavy rubber ring about 1½ in. thick under the brake drum surface. This ring absorbs the vibration of the





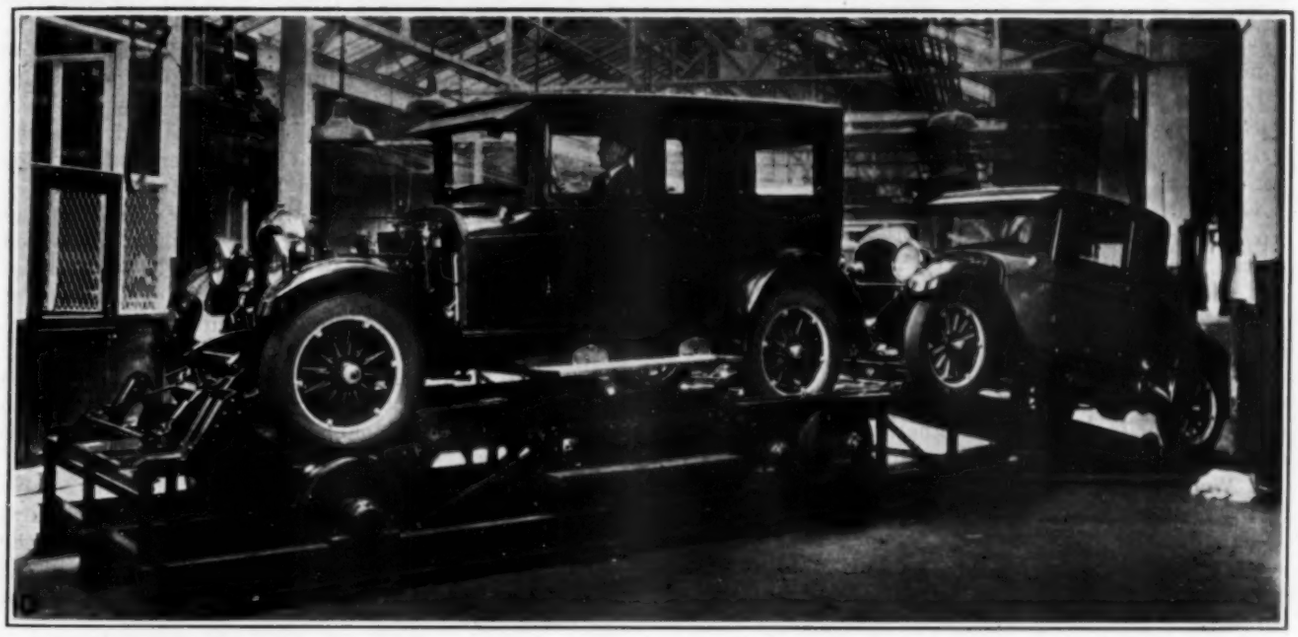


Fig. 8—Testing assembled cylinders and pipe lines under a pressure of 800 pounds. Fig. 9—Machining brake drum while secured to the wheel. Fig. 10—Running-in the brakes on Fennell road-testing machine

surface and allows a heavier, steadier cut to be taken.

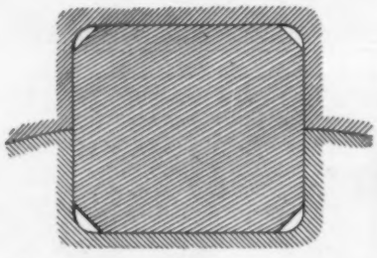
A final factor is the running-in of the brakes, both front and rear, under the power of the engine in the machine shown in Fig. 10. This machine is known as the Fennell road testing machine; it was designed and built by Mr. Fennell, the plant engineer. The engine drives the rear wheels of the car, and they drive the four cradle wheels of the fixture. A chain drive conveys power to the pulleys under the front wheels of the car. In this machine both front and rear brakes are run-in for two or three minutes, or approximately two miles, to get the first wearing surface or "whiskers" worn off. The brakes are then adjusted and the car is ready for the road.

Relation of Materials to Machine Design—Discussion

By W. R. Needham
Essex, England

ALL designers would do well to pay good heed to such considerations as Joseph Kaye Wood emphasizes in his admirable article under the title given above, on page 985, Vol. 61, of the *American Machinist*.

So many designers are apt to regard their end of the job as a thing apart. Even those who are fairly wide-awake, progressive, and generally well informed as to workshop methods, including machine-tool processes, pattern making, founding, smithing, etc., are prone to consider that the question of physical properties of materials of construction has reference to itself alone. Thus if the material is up to specifications as regards strength and stiffness they are satisfied. As Mr. Wood most opportunely points out, the machinability of the material is in most cases an equally vital factor. Thus certain materials are definitely ruled out for such requirements as demand ease of machining. The designer does not often mull matters, it is true; but it is usually by good fortune rather than of set intention. He certainly will steer clear of such omissions if he only recalls what is so eloquently urged by the writer of the original article.



Keyway with fillets in corners, and key having chamfered corners

Especially to the point are the remarks upon fatigue, and the insistence upon avoiding as much as possible, re-entrant angles. Abrupt changes in shaft diameters are, in modern high-class practice, condemned as the unpardonable sin of design. Quite rightly large fillets or tapers are made to give a stream-line effect to the structure. It is not every designer, however, who shuns sharp corners in keyways. I am in perfect accord with Mr. Wood's expert dictum, and deem it sane policy, as well as sound theory, to arrange keyways and keys as illustrated in the accompanying sketch. This is particularly advisable in high-speed machine practice where stress alternations may reach several thousand per minute.

The author of the original article refers to the theory of slip interference with respect to the granular structure of the material. Quite rightly he speaks of the extremely valuable work done in this connection by Jeffries and Archer.

British and European readers are probably more familiar with the earlier published writings of Dr. Walter Rosenhain, F.R.S., of the Metallurgical Dept. of the National Physical Laboratory, Leddington, England. In 1915, there appeared an admirable volume by Doctor Rosenhain entitled "An Introduction to the Study of Physical Metallurgy."[1] Chapters XI and XII treat very thoroughly and yet in simple language, of the phenomena of fatigue and the physical explanation thereof, in terms of slip bands and the like. They explain the influence the size of grain has upon the structure, and how the thermal treatment affects the structure and consequently the mechanical properties. The chapter headings are "The effect of strain on the structure of metals" and "The thermal treatment of metals."

Outlines on Metallurgical Development

Probably more popularly, certainly at much less length, Doctor Rosenhain outlines the twin developments of the new metallurgy in his essay "The Modern Science of Metals, Pure and Applied" in the splendid series of essays collected and edited by Dr. A. C. Seward, F.R.S., Master of Downing College, Cambridge, under the general title "Science and the Nation." Rosenhain's contribution sketches the progress made in the micrographical examination of metals, and in the thermal control and treatment of metals. At pages 62 to 65 he explains in principle what he elaborates in the larger work already referred to. Thus, how plastic deformation is accompanied by slipping of layers within some of the component crystals of the metal; how crystals reinforce each other; how refinement of grain assists against slip; how coarseness facilitates slip; the damaging effect of slip reversal and its effect upon fatigue—are all dealt with. So also is the relatively new weapon of synthesis, which thermal control and treatment have placed in the hands of the modern metallurgist.

An Important Branch of Research

English and European readers who are unacquainted with this highly important branch of modern research, so ably championed by Mr. Wood, will find Doctor Rosenhain's essay a most interesting and important introduction to this fascinating subject. They can then turn with advantage to the larger work already referred to, and would do well to read various later contributions by Rosenhain and others to the Institute of Metals. Neither should they neglect the work of the American experts, Jeffries, Archer and Heyn to which Mr. Wood calls attention. Mr. Wood's own paper "The Overstress in Metals," where he pioneers with an explanation of the characteristic shape of a complete stress-strain diagram, should not be overlooked. Americans on their part could with advantage supplement their sources (where they have not already done so) by reference to Doctor Rosenhain's valuable contributions to the science of metallurgy.

One looks forward to the time when the progressive changes in a metal, and their accompanying structural modifications, shall be explained for the benefit of the ordinary layman engineer. A close-up would stir the imagination of even the most prosaic member of the profession.

[1]The introductory volume of Constable's Metallurgical Series, the series being under the editorship of Doctor Rosenhain.

Ball Bearings in the Making

Special Correspondence

Balls are forged on Bradley hammers—Are ground with abrasive wheels—Heat-treated in continuous furnaces—Lapped and polished in special machines

IN THE early days of the ball bearing there were no complete bearings of this type available on the market, and the engineer who had the temerity to introduce them into a new machine was obliged to include in his design every part pertaining to the bearings except the balls.

As their anti-friction properties began to be understood and appreciated and the field of application widened to include power-driven machinery—especially power transmission machinery—a market for complete bearings was created and the development of the industry from that point to its present size was rapid.

Standard Steel & Bearings, Inc., a lineal descendant of one of the early companies, makes annular ball bearings of all commercial sizes, and every part of its product is made in its own shops. The methods and processes here described are employed in the making of balls ranging in size from ¼ to 1⅜ in. in diameter.

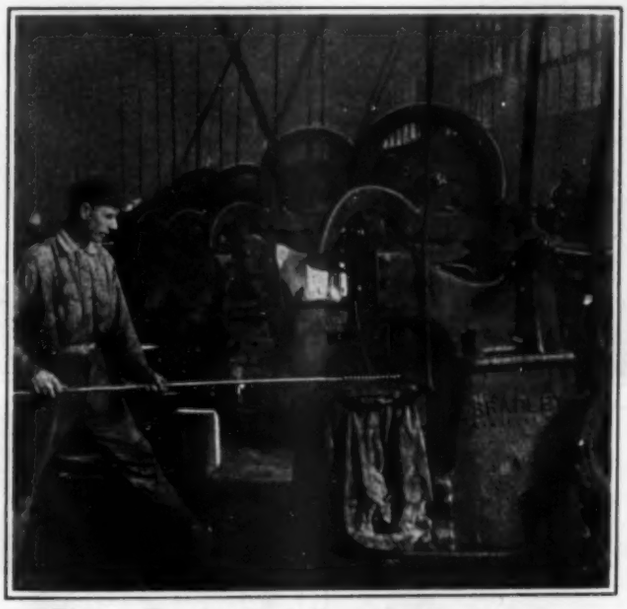


Fig. 1—Forging the balls on Bradley hammers

The balls are all die-forged on Bradley hammers from high-carbon chrome-alloy steel and pass successively through the operations of normalizing, annealing, rough-grinding, tumbling, oil-quenching, water-hardening, first and second lapping, polishing, burnishing, sorting and inspecting. The stock from which they are made is subjected to the same tests in the laboratory as is given to the ring stock, described in a previous article.

There is shown in Fig. 1 the first of a row of Bradley hammers on which the forging is done and Fig. 2 shows the forged balls before they are cut off the rod. Jets of water play on the dies during the forging operation to keep them cool. Each hammer is served by a press, as shown in Fig. 3, in which the forged balls are cut off the rod. This leaves the individual balls practically round, with but a slight flash at the point where they are severed from each other and from the rod.

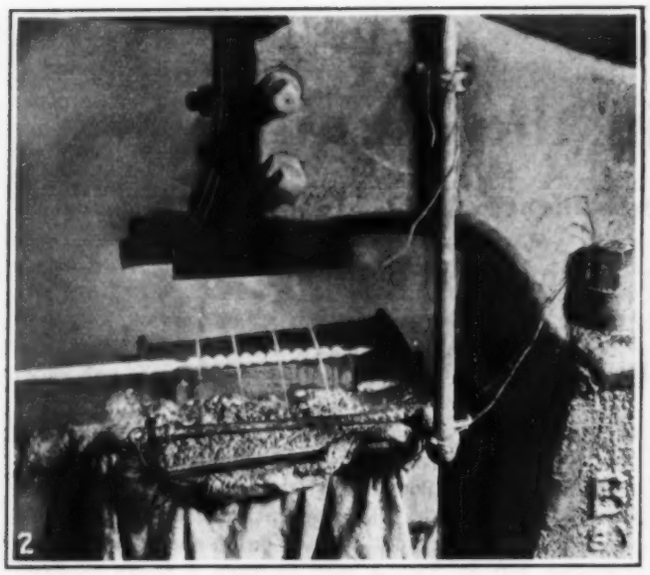
After forging, the balls are given a careful visual inspection, so that no cracked or defective balls need be passed along to subsequent operations. They are then placed in a furnace where they are heated to a temperature of 1,600 deg. F., from which they are allowed to cool in air. This operation is called "normalizing" and is at present carried on in small rotary gas furnaces, but in Fig. 4 may be seen a large oil-fired furnace that has been constructed for this operation and in which it will be continuous. The balls will be poured into the opening in the conical-shaped head, from whence they will follow a helical path to the opposite end of the cylindrical shell as the latter revolves.

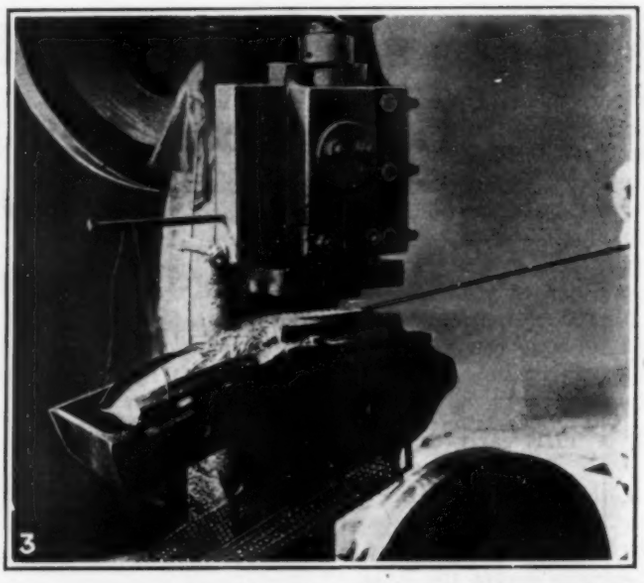
Though there are no operations upon the balls that involve the use of steel cutting tools, they are next thoroughly annealed by heating them to a temperature of 1,425 deg. and discharging them into trays in which they are covered with a heat-resisting compound called silocel and allowed to cool.

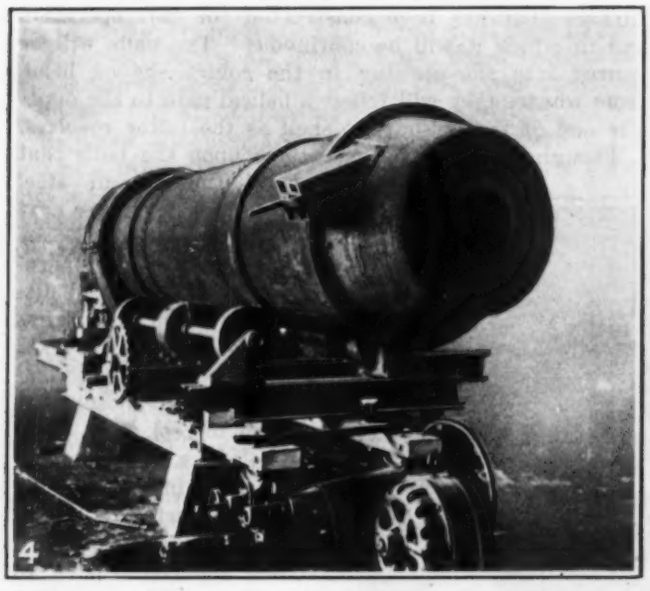
The next operation is rough-grinding the balls and is conducted in special machines that were designed and constructed in the shop. The grinding medium is a ring wheel mounted in a steel chuck upon the upper end of a vertical spindle. Immediately above the revolving wheel is a stationary raceway consisting of two rings of hardened steel, so disposed that they confine the balls radially but leave them exposed at top and bottom.

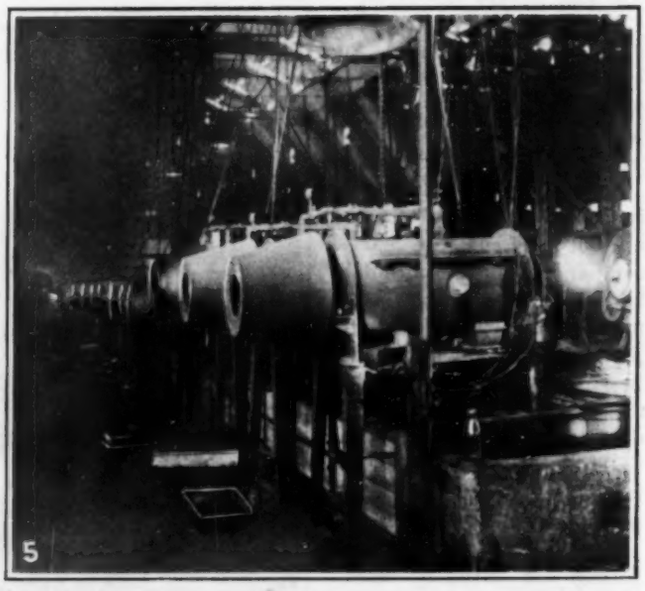
In the upper part of the machine is another vertical spindle, in line with the wheel spindle, but revolving at a comparatively slow rate and in a direction opposite to that of the grinding wheel. On the lower end of this spindle is a steel-faced wheel that bears directly upon the exposed upper surface of the balls.

The balls are thus constrained by the raceway to travel in a circular path between the steel wheel above them and the grinding wheel below. The bearings of the upper spindle are carried by a slide that has a vertical adjustment by means of a screw, so that the steel wheel may be fed down as the grinding progresses and keep the lower surfaces of the balls in contact with the









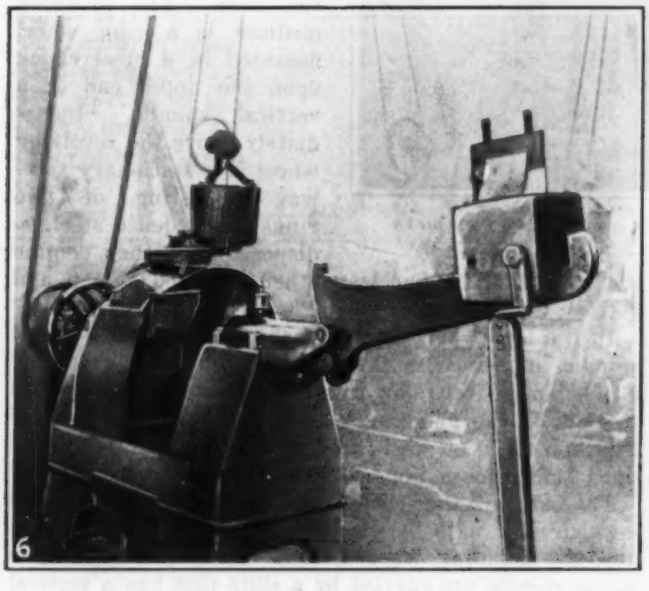


Fig. 2—A string of balls in the die. Fig. 3—Cutting off the forgings. Fig. 4—Rotary normalizing furnace. Fig. 5—The automatic hardening furnace. Fig. 6—One of the lapping machines. Fig. 7—Cleaning and polishing the balls

Fig. 8—The grading machines

grinding wheel. The stationary raceway is mounted eccentrically with relation to the wheel spindles so that as the balls are swept around the circle by the action of the wheel they are also caused to move rapidly back and forth across its surface, not only distributing the wear upon the wheels but also causing the balls to rotate freely in all directions.

Following the rough-grinding operation the balls are rolled with abrasive and water in iron barrels for several hours, after which they go again to the heat-treating department where they are heated in rotary gas furnaces in an atmosphere of hydro-carbon gas. The temperature is 1,500 deg., from which heat they are quenched cold in oil. This operation is called "oil-quenching," and its object is to improve and refine the grain structure of the steel.

The row of furnaces to be seen in Fig. 5 are the rotary hardening furnaces. The outer shell is stationary, and within it is a drum that is caused to rotate slowly by means of a worm and gear, driven by a chain and sprockets. The movement causes the balls to travel in a helical path from the conical hoppers at the front end to a small opening at the rear, from whence they drop out at a rate of about one per second.

The length of the helical path and the speed at which the drum rotates are so calculated that about forty minutes elapse between the entrance of a ball and its final discharge. The rate of rotation is variable through a speed-regulating device so that the time of heating can be changed in accordance with the size of the balls. The temperature of the heating chamber is maintained constantly at 1,420 degrees.

The final hardening is done in water. The cement tank under the furnaces is 15 ft. deep. At the rear end of each furnace and suspended in the water is a rectangular receptacle made up of bronze wire net and having within it a series of inclined shelves, or baffle-plates, so arranged that as each heated ball drops from the furnace and falls by gravity to the bottom of the tank it is compelled to take a zigzag course, and thus passes through a distance of several times the depth of the water in its descent.

Each receptacle terminates in a wire basket in which the balls are deposited, and when the furnace man considers that a sufficient quantity has accumulated in a basket he hooks on a small electric hoist and lifts the receptacle, basket and all, from the tank, empties the basket and returns the parts to the tank.

The hardening process is continuous, the duties of the operators being to keep the hoppers full of balls, empty the baskets at suitable intervals, and watch the heats as indicated and recorded by the pyrometers, which automatically manipulate the control valves of the burners to maintain the correct temperature. Balls smaller than ¾ in. are handled in the same way and

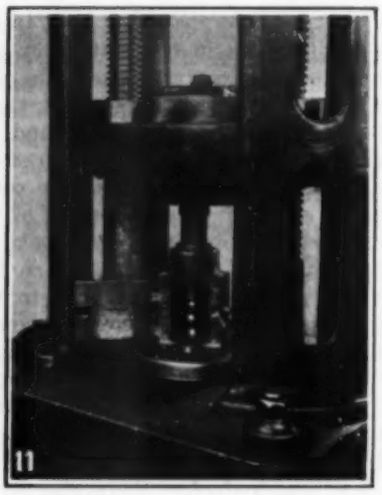


Fig. 9—Grading large balls by hand. Fig. 10—The final inspection. Fig. 11—The crushing test

Fig. 12—Device for sorting mixed sizes

in the same furnaces as the larger ones, but they drop into deep cylindrical containers filled with oil and suspended in the water.

The hardened balls are tempered by immersing them for a period of 30 minutes in oil at 325 deg., after which they are again inspected for visible defects. A certain percentage of them are tested by the Brinell method for hardness and broken under the Riehle testing machine to ascertain the average crushing strength.

The second operation of grinding is separated into three stages, called first and second lapping and polishing, respectively. Though the same type of machine is used for each, the three stages are kept strictly separate. Fig. 6 shows one of the machines.

Lapping and Polishing Machines

In these machines three concentrically grooved plates of cast iron are mounted in line with each other with the grooved faces abutting. The two outer plates are stationary while the one in the middle revolves. The mounting of the outer plates is so designed that they may be moved toward the middle plate, while the middle plate is made to float upon its driving shaft. The action of the weighted lever to be seen at the right in Fig. 6 tends to push the plates together.

Radial slots in the stationary plates allow the balls to enter the grooves between the plates from small hoppers on the sides of the casing that enclose them, from whence they are carried around by the action of the revolving plate while under pressure from the weight.

Momentarily freed from the confining groove of the plates every time it passes one of the radial slots, a ball may continue in the same groove or it may be pushed out into the hopper and return to a different groove. There are always more balls in the hoppers than the grooves in the plates will accommodate, so that the individual balls are continually passing from one groove to another, preventing uneven groove wear.

The distance between the plates is naturally determined by the diameter of the largest balls, thus bringing the pressure induced by the weight to bear upon them and reducing their size so that all of the balls are eventually reduced to uniform diameter. When all of the balls of a charge have been ground to the size for which the machine is set, the swinging support attached to the weighted lever comes to rest upon the floor and the grinding stops for the reason that there is no longer any pressure upon the plates.

From the small hopper to be seen at the top of the machine a stream of abrasive suspended in oil is allowed to run upon the balls. A mechanically operated agitator in the hopper keeps the mixture of a uniform consistency. The abrasive used on the first lapping operation is South African emery of 180 grain. The second lapping and the polishing operations are exactly the same as the first except that the abrasive used for the former is FFFF crocus, while for the polishing lampblack mixed with water is substituted.

After the lapping operations are completed the balls are round, but they present the dull gray surface of a lapped job. In order to impart a luster to the surface they are rolled, first in a soda solution to clean them, next in sawdust to dry them, and, finally they are rolled for several hours with small scraps of leather to burnish them. The wooden tilting barrels shown in Fig. 7 are used for all these operations.

The grading machines, Fig. 8, each supplied with balls of one nominal size, will detect variations in diameter of 0.0001 in., and will deposit the balls in the drawers beneath in accordance with these minute differences.

The balls are dropped one by one with clock-like regularity on the upper end of an incline consisting of two hardened steel straightedges so placed with respect to each other than the space between them increases slightly toward the lower end. As a ball rolls of its own weight down the incline it reaches a point where the straight-edges are sufficiently far apart to allow it to drop between them, when it falls into a conduit that conducts it to the proper drawer. If a ball is appreciably oversize it will not pass between the straight-edges at all, but will roll off the end into a box.

The grinding machines do not handle balls larger than ¾-in. in diameter. The operator in Fig. 9 is sorting large balls by passing them between the measuring points of a sensitive dial gage, and is depositing them in various receptacles in accordance with their size. These balls are of course all of one nominal size and the maximum variation is small.

Every ball, however large or small, passes at least twice under the sharp eyes of an inspector who is especially trained for this work. A handful of balls is deposited in a small glass-bottomed tray as shown in Fig. 10, where they are shaken up and rolled about by slipping a card under them until the operator is satisfied that there are no cracked or otherwise defective balls among them.

Though this operation is dependent in large degree upon sharpness of vision, backed by long experience, there is nevertheless a knack about it that enables the trained inspector to spot a defect that an untrained observer would need a powerful glass to discover. As the balls lie before her on the glass plate the inspector holds a white card or piece of celluloid before them in such manner that it is reflected in the polished surfaces of the balls.

In this reflection the straight edge of the card appears, not as a straight line but as a curve, the radius of which changes with every movement of the card. The girl thus has before her a dozen, a hundred or perhaps a thousand, curves—depending upon the number of balls in the tray—all supposed to be just exactly alike. If one of those curves appears or acts in a manner different from the rest when the card is moved it is sure to indicate a defective ball.

Testing for Yield and Crushing Pressure

Several balls from each lot are tested to destruction in the Riehle machine before the lot is allowed to go into stock. Three balls are stacked as shown in Fig. 11 in the testing chamber, the door closed and pressure gradually applied until one or more of them yields under it. The machine records the amount of yield and the ultimate crushing pressure.

An ingenious device, shown in Fig. 12, is used to separate balls that have inadvertently become mixed in the shop—which does not often happen—and also to sort the balls that are returned from the salvage department. It consists of an inclined trough the bottom of which is made up of gratings with progressively increased width of spacing.

A quantity of balls of all sizes may be dumped into the hopper at the top of the incline, and as they roll down it they disappear between the bars of the gratings and reappear, correctly sorted to ⅛-in. sizes, in the receptacles arranged to receive them.

Machine-Shop Transportation with Industrial Electric Trucks

By Harold J. Payne
Society for Electrical Development

Use of electric trucks for general shop work — Signal system for controlling their use—Oversized tires—Each unit equipped with ampere meter — Crane-type truck

ALTHOUGH the last ten years has marked an era of pronounced progress towards the reduction of overhead expenses in many shops, numerous gaps still remain through which dollars are passing, without netting satisfactory return. This holds true especially with regard to the transportation of parts in process. On this account, equipment manufacturers have used considerable energy in producing mechanical conveying appliances to eliminate costly hand operations. Developments of this sort, that have taken place since the labor shortage created by the war, have been cataloged so frequently that repetition is unnecessary. It is significant, for the purpose of illustration, to point out the accomplishments of but one class of equipment, namely the industrial electric trucks.

In machine shop practice, it is estimated that the average units produced require handling from ten to fifteen times. Hand trucks or flange-wheel cars on narrow-gage industrial railways, may be used for carrying the work in the shop from one operation to another, but in either case the labor requirement is heavy, movements are often slow, and the work is frequently arduous. It is in recognition of these facts, that the De La Vergne Machine Shops, located in New York City have adopted industrial electrics.

Realizing that changes of transportation methods are made by slow degrees, this company purchased a single truck, of the heavy-utility type, six years ago, and at intervals of two years, new trucks of the modified-crane and light-utility type have been added. Each unit was purchased to function in a specific manner, and has given such satisfactory results, that it is planned to expand the fleet.

At this plant, as at many others where trucks are proving invaluable, operating conditions are far from ideal. The layout of the various buildings is not modern, the elevators are small, the roadways are poorly paved and the aisles in the shops are extremely narrow. Buildings are situated on both sides of a private roadway, about 1,000 ft. long and all departments are accessible from this avenue, so in the course of every haul, the trucks or "tractors" as they are inaccurately called, use this artery.

To keep each department supplied with rolling equipment, either truck or trailer as the need arises, a signal system comparable to that used for regulating traffic on Fifth Avenue in New York has been installed. Three lights, red, green and white, are placed outside of the departments, and when need arises for moving, the signal is lighted, attracting the attention of tractor man as he crosses the roadway. In this way two useful objects are attained; prompt service is made possible and the idle time of the tractors is eliminated. The trailer equipment consists of eight 3-ton and of three 5-ton units substantially built, so that a load larger than their rated capacity, can be hauled. Heavy castings and crates are carried from one shop to another, or to the shipping department, such as shown in Fig. 1. The load-carrying trucks at this plant are used as tractors, as can be seen.

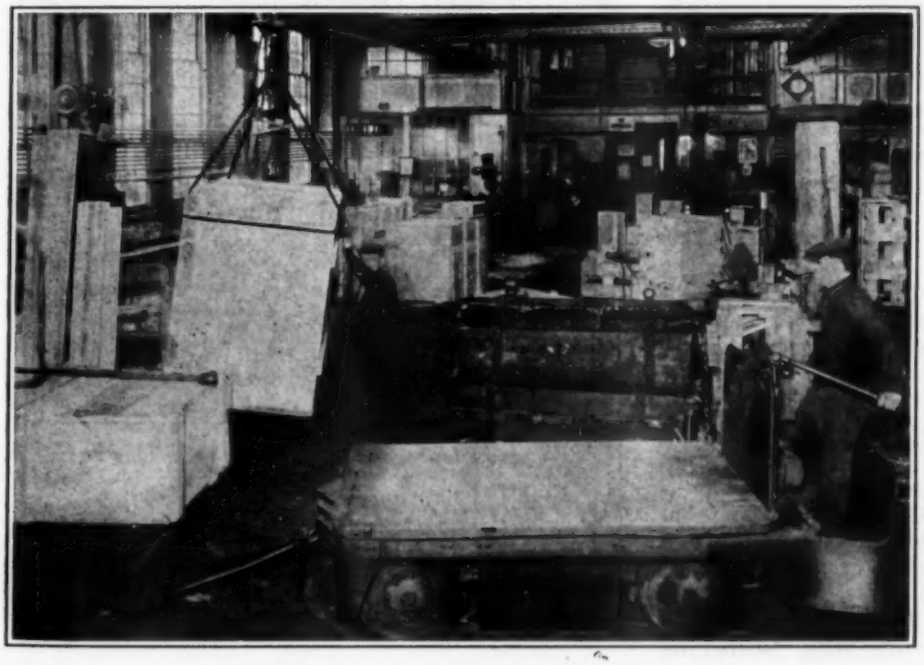


Fig. 1—Electric truck in the shipping department

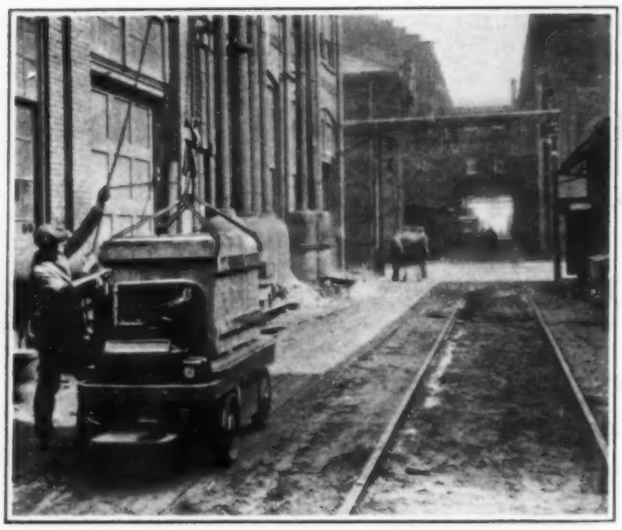


Fig. 2—Roadway used for transportation purposes

On account of the difficult turns necessary within the plant, four-wheel steer is standard, and to meet the paving condition, in some spots muddy and rough, 5-in. tires are used to replace the usual 3½-in. equipment. The view shown in Fig. 2 illustrates a heavy crate being transported in the roadway that runs through the plant.

The aisles have a limited clearance, the elevators are small and some of the curves appear impossible, yet, rapid, accurate delivery and pick-ups are made for each worker.

All trucks are equipped with ampere meters to record the condition of the batteries. In this way, the necessity for an occasional boost is determined, although it is seldom necessary to charge batteries except at night. When a heavy job is scheduled late in the day, batteries are boosted at noon to insure sufficient power for the completion of such work.

The crane truck, shown in Figs. 4 and 5, is useful on a variety of work, and at times, loaded freight cars, weighing from 75 to 100 tons, are moved out of the shipping shed when a locomotive is not available. Roadway conditions are not entirely satisfactory for this kind of work, yet, the trucks makes little effort in performing such operations. These trucks pick up castings weighing up to 2,500 lb., and carry such loads the length of the plant in comparatively short time.

This means of transportation aids in eliminating delays, and increases the efficiency of production methods. New uses for the trucks are being found daily. The system is giving satisfaction, and is much quicker and less expensive than the earlier hand-trucking methods, so that the electrics, instead of being unappreciated, are considered as essential as machine tools.

Fig. 3—Transporting work in the machine shop.

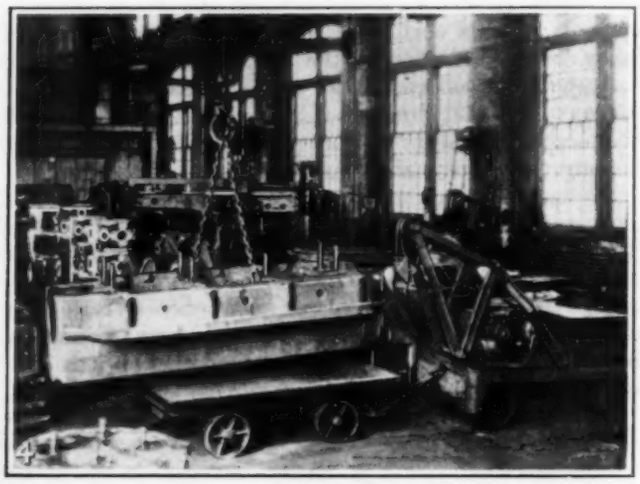


Fig. 4—Loading a heavy casting

The upkeep and repairs are found to be low. Trucks purchased with nickel-alkaline batteries six years ago, have not required replacement, and for lubrication, spare parts and repairs the total cost is under $200 per year, per truck. Considering that each truck is busy throughout the working day, and that five men are made available for other work by each unit (according to the experience of the company), the net cost against the savings effected has shown tangible dividends on the investment made. In another plant, conducting similar work on a larger scale, accurate cost records show that a net saving of 225 per cent has been effected by the use of electric-industrial trucks, as against manual methods.

In the departments machining heavy parts, 10-ton bracket cranes are used for unloading the work from the trailers when the heavy shop cranes are busy, reducing idleness to a minimum.

The services rendered by the light utility truck are of value, especially in the machine shop, located on the second floor of an old building, shown in Fig. 3.

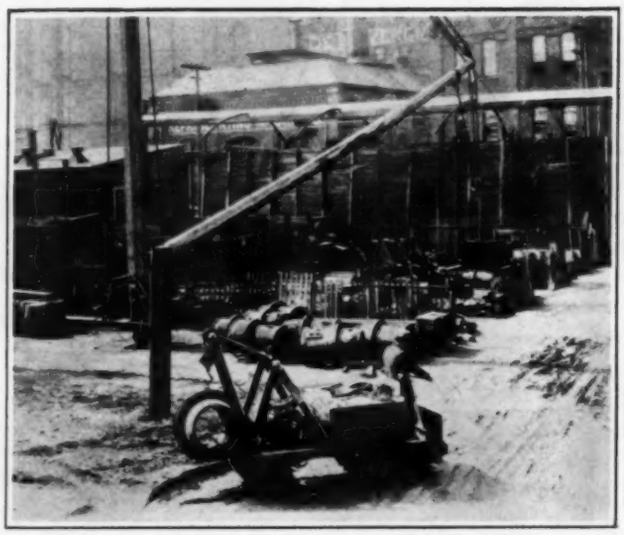


Fig. 5—Hauling work through the plant yard

Various Viewpoints of Standardization

By A. H. Timmerman
President, Electric Power Club
Vice-President and Chief Engineer, Wagner Electric Co.

Productivity of the individual increased — Effect of modern machine tools — Quality of output improved—Cost of clerical labor and material reduced

IT WOULD perhaps be difficult to trace the development of standardization from its inception up to the present time. However, it is quite certain that in olden times before the invention of machinery, the individual workman put into each article he made more or less of his own creative ability. It was not until the invention of machinery that parts of the utensils or apparatus to be constructed began to approximate the same shapes and dimensions. Many years elapsed, however, before it became recognized that the interchangeability of parts was a real aid in reduction of the cost of manufacture, and it apparently required a still further step in our analysis of the situation, to realize that by using the same part in different pieces of apparatus, even at an apparently higher cost of the individual part, we could at times considerably reduce our cost of manufacture.

The development of the same idea has naturally led to that of mass production, by which an article of apparently greater cost can be made for much less outlay by increased production than can other articles seemingly less costly, when made in small quantity. Thus general interchangeability of parts leads up to the idea of standardization of material in general, of the parts entering into manufacture, and of complete units. The tremendous effect of this quantity manufacture on the comfort and even luxury in living of the modern workingman is often overlooked, due to our having become so familiar with the better living conditions of the people generally. We do not ordinarily realize that the great mass of the American people today is living in greater luxury than were the kings of a few centuries ago. This can be due only to the fact that the productivity of the individual, due in a great measure to standardization, has been so enormously increased in our modern industrial development.

Wide Range of Manufacture

We, therefore, see that a certain process of standardization has been going on for many years. On the other hand, the introduction of modern machine tools with their great flexibility has enabled us with comparatively little effort to make parts of a very wide range of design. This is particularly true in the gear manufacturing industry, in which we have found it quite simple to obtain a very wide range of diameter and pitch, and wide variation in tooth shape. Similarly, in the electric-motor business we have found it quite easy to obtain different strengths of motor in different frames by modification of the windings. These variations led to a departure from standard which it is continually necessary to watch in order to prevent abnormal rise in cost of the whole product. We must not overlook the fact that, if we are running 90 per cent on standard output, the introduction of 10 per cent off-standard apparatus not only causes the cost of that 10 per cent to be abnormally high, but if the work is performed in the same department, materially increases also the cost of the standard product, for the reason that every employee handling the material must be sure that he has the proper parts to make the apparatus to the desired specification.

Standardization of Material Supply the First Effort

In undertaking any general program of standardization we must start with our material supply. Some years ago when the business of the company with which the writer is connected was very much smaller than it is today we began to standardize our material supply and found that in many cases we could reduce the variety of material to one-third or even one-fourth of the original used. Standardization of this kind is very far reaching. It reduces the work on the part of the draftsman in deciding what thickness to use, as he has certain specified thicknesses only which he is permitted to use. If the total kinds of material used have been reduced to one-half, the manufacturer should be able to get along with approximately one-half of all clerical labor in departments which are involved in the specification, purchase, production and handling of the material in question. At first a program such as the above seemed very radical and questionable as to the result to be obtained, but after having the system in use for the past fifteen years we find that except for additions in sizes above and below the maximum and minimum sizes previously used, our material list remains practically the same today as when originally adopted.

Standardization work in the electrical industry was started approximately fifteen years ago. At that time there existed a large variety of voltages, frequencies and speeds of electric motors. Each manufacturer had his own voltage standard, with the result that the customer was likely to ask for any of the voltages in use. This made it necessary for all manufacturers to be prepared to bid on contracts calling for any of the recognized voltages and make up efficiency and power-factor guaranties for the whole range, often entailing very considerable expense.

With the introduction of standardized voltages, frequencies, speeds, etc., the commercial situation became

Presented at the ninth annual meeting of the American Gear Manufacturers' Association, Pittsburgh, May 6-9.

much simpler. Similar standardization has been going on in many branches of the industry.

As distinct from standardization, which really consists in the listing of a number of standard sizes and standard characteristics, we have simplification, which is being carried on under the direction of the Department of Commerce. This consists, as you are probably aware, in the elimination by agreement of manufacturers and the Department of Commerce, of certain sizes and types that are deemed unnecessary. Standardization, on the other hand, does not eliminate by agreement any previous items of manufacture, but recognizes as standard certain items only.

By the use of standardized lists the total stock of raw material required can be greatly reduced and at the same time be more available for a large variety of apparatus. Similarly the standardization of product being manufactured reduces the total stock in process, and at the same time enables the manufacturing department to make better deliveries than can be made on departures from standard.

Lessens Seasonal Employment

One of the most serious problems the manufacturing industry, as well as the country as a whole, has to contend with, is seasonal unemployment, with its resultant distress and dissatisfaction among those who suddenly find their incomes either reduced or entirely stopped. It is perhaps in this direction that general standardization of product has had a more far-reaching effect upon our industrial life as a whole, than any other development in the past quarter of a century. With a standardized product the manufacturer is enabled to build for stock during the dull season, and thereby insure his employees a reasonable compensation throughout the year. This, of course, assumes that he is financially able to carry the burden of the increased labor and material necessary for carrying the increased stock over such periods. It has often been suggested that the proper way of tiding over such a period and keeping a plant going is by reduction in selling prices, thereby causing a greater flow of orders to the individual plant. This reasoning, however, is manifestly erroneous, because if all manufacturers in a given line used the same method the result would be a decrease in net return for the apparatus sold, without any increase in activity, in that branch of business. The building of stock, however, over such seasonable periods offers a safe means of keeping employees happy, provided the business is not concerned with products that have a style variation.

If a plant manufactures only one article, it can very readily be seen that the overhead force in the designing and manufacturing departments can be reduced to a minimum and, although not so generally recognized, it is equally true that the sales force can be correspondingly reduced. As the number of items of manufacture increases for a total given volume of output, the overhead force must be correspondingly increased with a very considerable increase in cost of product.

As to quality of output, it has long been recognized that the degree of accuracy required in interchangeability of parts incurs a far better quality than can be obtained in departures from standard.

We sometimes overlook the tremendous burden we are placing on our manufacturing departments in the great multiplicity of parts that they are required to oversee. If the brain power expended in bringing through this variety could be concentrated on a few products, it is not difficult to understand how the labor and material costs of such parts could be reduced in many cases to a small fraction of the original figures. It seems rather paradoxical at first thought that the great reductions in cost obtained in standardized manufacture are often secured through the introduction of machine tools built specially for the purpose. It is not, however, as paradoxical as it may seem, as often the specialized machinery of today, developed for making special parts, becomes a standardized machine a few years hence.

With all the effort expended in the reduction of factory costs, through standardization, why is it that we still use in many cases the same selling methods used a half century ago? Why cannot our commercial practices be standardized in a similar way to our manufacturing practices? Why should it cost as much to sell an article as it does to design and manufacture it, including the cost of productive labor, material and overhead?

It has sometimes been asked, can standardization be carried too far, and if so, what will be the logical result? The writer is of the opinion that standardization can unquestionably be carried too far. First, if standardization is carried to the extent that it prevents or tends to dampen progress in the art, it would become a serious menace to the prosperity of the industry. Second, if it is carried to the extent that there is no difference between the articles or apparatus offered for sale by manufacturers, there is left only one basis of difference and that is selling price. This is, from the writer's viewpoint, just as serious to the industry as stopping the progress of the art.

Competition May Become Destructive

If no two manufacturers were building the same articles there would be no competition in the selling of such articles. As the number of manufacturers building the standardized material becomes greater, competition becomes keener. If all manufacturers in a given line of apparatus build articles that are identical, competition may become so keen as to be destructive, particularly at a time when the total available business is less than the manufacturing facilities of the country. Such a situation may result in the survival of the fittest. This does not necessarily mean the survival of that organization which puts the best efforts into the manufacture and sale of a particular article. It may mean the survival of that manufacturer who on account of his greater variety of business, some of it in non-competitive fields, may be able to offer for sale at no profit those highly competitive articles, and still remain in business due to profit on his non-competitive lines. This may result in the elimination of the smaller manufacturing unit, to the great detriment of the manufacturing industry as a whole, as well as eventually to the buying public. Under such conditions standardization may become a detriment to the smaller manufacturer.

Recognizing as we do, however, the great advantage of standardization to the general public, as well as to the industrial development of the country, we must find a way of overcoming this apparent undesirability.

It would seem that a logical solution of any such situation would then be the standardization of price as well as the qualities and characteristics of the product. Such standardization, however, could be carried

on only, if at all, under federal control. This seems at first thought a very radical departure from our present ideas of competition in industry. The thought underlying the above suggestion, however, is not radically different from that involved in the fixing of freight rates by the federal government for all common carriers in the United States, nor is it radically different from the present situation in the electric light and power industry, with this difference, however, that in the latter case we have state instead of federal control of prices.

The government recognized the right of the public to be protected against any combination of manufacturers that would result in the paying by the public of abnormal prices for any manufactured article. It also recognizes the right of the farmer to secure a reasonable return for his efforts, as evidenced by the many proposed laws introduced in congress during the last few sessions. It further recognizes the right of the employee to obtain a fair return for his efforts, as evidenced by railroad legislation. It cannot, therefore, deny the manufacturer his right to secure a fair return on his efforts and his investment.

Standardization is having a far-reaching result not contemplated at the time of its inauguration, and a continuance of further standardization must be followed by such industrial legislation as will reduce the effects of the present very serious competitive situation.

The enormous industrial expansion during the war and the years immediately following, when labor and general production were very inefficient, has left us with a manufacturing capacity that is quite excessive and which is likely to be in excess of requirements for some years to come. The reduced price at which apparatus is sold today, and the lower margin of profit secured, make it necessary that we increase the output of our plants in order to secure not only a reasonable return, but in fact *any* return on the investment. As a result all manufacturers are trying to secure more and more business with a resultant further steady decline in selling prices. It is questionable if this decrease in the price at which many manufactured articles are being sold can be compensated by decrease in the cost of production due to improved design or manufacturing methods.

The question which needs the very serious consideration of any industry as a whole is: Is further standardization desirable at this time, if it results in further increase of capacity of our manufacturing plants without any visible increase in the probable demand? In consideration of this question we should note carefully the difference between standardization of the individual manufacturer's product and standardization of the product of the industry as a whole.

There is no question in the writer's mind but that standardization in the long run is beneficial, not only to the industry, but to the general development of the country as a whole, in that it increases the productivity of the individual and results in the betterment of living conditions of all elements of our population.

Development of the Gear Art

By Frank Burgess

President & General Manager, Boston Gear Works, Inc.

WITH the advent of machinery to cut the teeth in gears, we arrive at the first real step in the "Development of the Gear Art."

While the fixed-form cut gear for general machine purposes was a great improvement over the cast tooth, it was fully another quarter of a century before the next decided advance was noted, which was in the form of the "generating process." This brought into more general use the involute form of tooth for which the Brown & Sharpe Manufacturing Co. deserves a great deal of credit in standardizing the tooth dimensions and manufacturing a full line of cutters.

This involute form of tooth gradually replaced the epicycloidal or similar form which had previously been in use. The "generating process" also brought the development of the stub tooth with increased pressure angle which is used so extensively and successfully to-day in the automotive field.

This generating process also made it possible to produce helical gears with more accurate tooth form and spacing, thus accomplishing the first real step in the direction of a *quiet gear*.

It is generally accepted that this generating process is fundamentally sound and that future development will be along the line of refinement only.

With gears made more accurately as to tooth spacing and tooth contour, higher speeds were obtainable, which in time, revolutionized machinery manufacturing giving us today rapid production automatic machines, which have affected industry as a whole and which could be called marvels of their kind.

With the advent of this high speed machinery, it became necessary to develop a more quiet gear than that of the straight tooth spur gear for parallel shaft drives, and much attention was then given to the development of the helical gear, both single and double (herringbone), which today have become very popular drives where high speed and quiet operation are required.

The single helicals have been the more popular in the past due to the fact that they usually required less space and were more economical to manufacture, but are confined more to the light drives where the end thrust is not objectionable.

The double helicals, however, have the advantage in that they can be run at high speed and at the same time transmit heavy loads without the disadvantage of the end thrust. The wide face, which has usually been considered as necessary for this type of gear, can be reduced to practically that of the single-helical or straight-tooth spur, by the use of the stub tooth and the proper selection of pressure and helix angles as well as the cutting method itself.

As a quiet-running gear seemed to be the principal demand of the age, the use of non-metallic materials became necessary.

We must not overlook the great developments in the right-angle drives, as for example, miter and bevel gears. As we all probably know, Hugo Bilgram of

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Abstract of paper presented at the ninth annual meeting of the American Gear Manufacturers' Association, Pittsburgh, May 6-9.

Philadelphia many years ago produced some of the first bevel gears with generated teeth.

This type of gear was further developed by the Gleason Works of Rochester, N. Y., which later brought out the spiral bevel gear that has been so successfully used in the automotive field.

The worm gear is another type of right-angle drive that has come in for considerable development. Perhaps its principal asset has been its quiet and smooth operation and its principal disadvantage the friction usually developed by the sliding-tooth contact. This disadvantage, however, has been and is being overcome.

Form of Gear Teeth

I have previously mentioned the advantages of using the hardened gears for parallel drives where great strength and minimum space are required and also pointed out the fact that the disadvantage due to the distortion caused by hardening prevented them from being used for a quiet drive at any great speed.

This leads us to the point where serious consideration must be given to the *form* of gear teeth. While of course, it will be agreed that this has always been a factor, yet the rapid developments have forced more careful consideration of this point recently since the simple "running-in" or burnishing of gear teeth to correct inaccuracies cannot be applied here as in the case of soft gears, therefore some other means must be found.

The most recent developments in the gear "art" in the last few years have to do with the refinement of inspection instruments and gear machinery itself, such machinery being more rapid and made with fewer parts to permit gears to be cut more accurately as to curve of tooth, spacing, concentricity and smooth surfaces.

With such improvements in gear-testing instruments, we are able to practically visualize the "noise" in a pair of gears and definitely place the fault on either the machine or the cutter. So today we have the gear-cutting machine, the cutter and the method itself in a three-cornered race for supremacy, which has been the means of bringing the manufacture of gears up to the stage of a real "art."

There is a field for some tool manufacturer in this country to get out a simple noise-testing instrument with recording device, such as is being worked on abroad, so that the noise can be standardized as the ordinary measurements are standardized to-day. It is my opinion that such a machine will be in great demand in the no distant future.

Is it not true that the final test of a gear is the noise test, and regardless of what instruments have been used to check the accuracy of the gear in its manufacture, if it is noisy it is rejected?

Perhaps one of the most important developments of recent years is that of the ground-tooth gear. While it is a fact that the teeth of some types of gears have been ground with more or less satisfactory results for some years past, it is only quite recently that the ground-tooth spur gear has been used to any great extent and this particularly in the automotive field.

It is a fact, however, that manufacturers are now realizing the importance of smooth, efficient and quiet drives; therefore considerable thought has been put into this subject.

Ground-Tooth Gears in Infancy

It is my belief that this type of gearing is only in its infancy. The machine tool industry is gradually realizing the importance of a durable and practically non-friction gear and therefore we now find that the hardened- and ground-tooth gears are being embodied in machines in the industrial field. This no doubt will be more in vogue as the methods for producing them are improved and the cost of production is lessened.

Some of the advantage of this non-friction product might be summed up as follows:

Maximum durability. Many times that of soft gears.
Maximum efficiency.
Maximum horsepower. Many time that of soft gears.
Minimum weight per horsepower.
Minimum space per horsepower.
Warpage eliminated, therefore much better than ordinary burnished gears.

To my mind the only disadvantage of the ground tooth gear is the expense of production, but recent developments would indicate that this obstacle will soon be eliminated and this practically non-friction product will become an important milestone in the development of the gear art.

What Are the Future Possibilities in Gear Manufacturing Equipment?

By F. W. England
Vice-President, Illinois Tool Works

THE purpose of this paper is to deal with the present period, the period of the alloy steel gear, and also to give our imagination the freedom to depart from the beaten path in visualizing the future.

The question before us is, what are the future possibilities in gear manufacturing equipment? The writer of this paper intends to answer this question only in a speculative way, as no one knows today or can guess approximately what further unfoldment may develop in all the inventive minds now pursuing this subject.

The generating process of forming the teeth in gears is undoubtedly the greatest radical step taken in connection with developing gear-cutting equipment, a step that has survived and is today by far the leader.

Cutting and grinding machines using the generating principle now turn out large quantities of gears where machines using older methods turn out comparatively few. The gear hobber, the gear planer, the gear shaper and most gear grinders are generating machines. Generating has thus become an important word in gear

Abstract of paper presented at the ninth annual meeting of the American Gear Manufacturers' Association, Pittsburgh, May 6-9.

nomenclature and will, undoubtedly, be used to classify further developments of the art.

Further developments of the generating process will undoubtedly take place and to this will be added automatic loading and unloading devices. We should be able to visualize machines with magazine loaders, continuously moving generators, gear blanks automatically fed to the generators and finished gears departing from them by conveyor to be placed in the automatic loader of other machines to perform the next operation.

Possibilities of Casting and Swaging

It is not beyond possibility that alloys may be developed that will allow of casting gears in molds and obtaining equal strength to those now made by forging and cutting. These cast gears would probably be finished by grinding only, by helichoidal grinding wheels of unusually large diameters and with several gears being ground simultaneously.

The possibilities of the swaging process applied to steel have not been exhausted. Eventually we may have completed gears formed by enormous pressure during sufficient time for the alloy material to flow into accurate molds.

The hot-rolling and forming of gear teeth is already being done and this method may, in connection with a rapid and accurate finishing process such as grinding, develop into a very important factor.

A great many gears, such as internal gears, herringbone gears, cluster gears, etc., can be profitably made only by either the planing or shaping method.

The various types of gear planers and the gear shaper have been perfected to generate these gears and also spur, spiral and special gears to a high degree of accuracy and comply with standard systems of gear-tooth curves.

Spur and spiral gears, sprockets, spline shafts and a variety of special gears are made by hobbing, which has surpassed its brother methods in rapid production of high-grade work.

We Have the Fundamentals for Further Progress

Cutting of gears by the generating process is today an acknowledged success. Producing them more rapidly and more uniformly accurate is a desired attainment. Persistent desire and devotion of efforts brings realization, and so we have the fundamentals for further progress.

It has been agreed that discoveries are unpredictable, or rather that despite prediction, the unpredictable will sometimes burst forth in startling unexpectedness. May this be true or not, the time is ripe for the prediction that automatic generating machines equipped with hobs made of steel of increased strength and hardness will soon appear at the horizon of thought to find someone to pilot them safely to shore.

Present hobs are cylindrical cutters of comparatively quick peripheral curvature and they will, therefore, not form straight gear teeth without traversing the face of the gear. Hobs of larger diameter have slower curvature and can be fed faster without affecting the finish, but economical construction of a hob of sufficient diameter to cut a gear within practical limits, without the traverse feeding, is beyond comprehension.

A suggestion for a hobber may be derived from the caterpillar tractor. Such a machine would have an endless chain for a cutter, a chain provided with hob teeth, against which the work would be fed radially. Whether or not any such radical departure from present methods of hobbing gears will take place, either in the near or remote future, present indications are that the hobbing process is and will continue in the lead of other processes by a good margin, because there is no other method where as large a number of cutting teeth can be so advantageously employed simultaneously.

With further reference to steel for making cutting tools, metallurgy has opened up a bewildering new science in which those who will lay down for themselves a program of exploring, will reveal possibilities unsuspected before.

The Art of Gear Grinding

The art of gear grinding, and equipment for grinding gears, bring us yet closer to present-day developments and in considering the future it affords even a better subject for reflection than equipment for cutting.

Grinding in general is comparatively new and the rapid progress it has made furnishes many examples that can be used for comparison in dealing with the future of gear-grinding equipment.

No one will argue that cylindrical surfaces can be turned or that flat surfaces can be planed as well as they can be ground today and yet we sometimes hear opinions expressed that ground gears are no better than planed gears, or shaped gears, or hobbed gears.

Let us be grateful that they are as good and that the method has already been developed to where it will at least compete with gears furnished by the aforesaid methods.

Considerable difficulty has always been experienced in the manufacture of hardened-steel gears due to the warping which invariably occurs during the heat-treating process. This warping, while it may be very slight, is largely the cause of what is termed noisy gears. This defect can be remedied only by a process that will finish the teeth after heat-treatment.

A number of grinding machines for grinding gears have been developed in the last ten years, most of them designed to work on the unrolling principle. Some of these machines used steel bands, others use rack and gear to rotate the work and all of them embody a device for indexing.

Gear Grinding Still to Be Developed

In spite of all the experiments and machines built for grinding gears, gear grinding has not yet come into its own. Is it not waiting for the grinding machine that works on the continuous molding-generating principle, the machine that will be to grinding what the hobber is to milling and planing? I believe the time is not far away when such a machine will be developed and will revolutionize the method of making hardened gears. In fact all gears will then be ground for the same reason that it is less expensive today to produce accurate cylindrical work on a grinder than it is on a lathe, even though the material be soft.

It has often been said that a hob with an infinite number of teeth would fulfill the requirement for generating perfect gear teeth. The abrasive hob complies with this theory, as the number of cutting teeth in a grinding wheel approaches infinity.

Present-day gear-cutting equipment for finishing purposes may, therefore, largely be replaced by grinding in the near future, but there will still be a place for planing, shaping and hobbing.

Book Reviews

Thermal Expansion of Aluminum and Various Important Aluminum Alloys. By Peter Hidnert, Associate Physicist, Bureau of Standards, Washington, D. C. Thirty-four pages, 7x10 in., paper covers, illustrated. Published by the Bureau of Standards as No. 497 of a series. Price 15c.

The paper constitutes one of the scientific series being written on the results of tests and research carried forward under the direction of the Bureau of Standards. Aluminum and the important aluminum alloys are investigated, the apparatus is described and the results obtained are tabulated.

The Foreign Service of the United States. By Tracy Hollingsworth Lay, Consul General of the United States. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York. Four hundred twenty-eight pages, 6x9¼ in., cloth boards. Price $5.

This book deals with the work of the established governmental machinery of administration, known as the Foreign Service, comprising our foreign representation. This department is a branch of a vast system controlling our international relations through which the nation expresses itself to the foreign world. The various branches, agencies, systems and duties are dealt with, making this book comprehensive within the scope of its title.

There has been little loss in condensing this subject matter into one volume as it contains a full description of the reorganized Foreign Service, prepared by a representative of this department. This book is not an official publication, nor has it been written with a view of giving official opinion. The author gives a number of constructive proposals for the further improvement of the machinery of our foreign relations and points out the need for a strong foreign service.

Honorable Charles Evans Hughes has contributed a valuable foreword for this volume, that should be of interest to anyone concerned in the foreign relations of our government.

Budget Control. Thirty pages, 6x9. Prepared and published by Ernst & Ernst, New York.

The principles of budget control are briefly and clearly stated in this booklet. It first takes up the reasons for budgeting and then explains how the master budget is made up from the sales, production and purchase, expense, plant addition and plant charge, and cash budgets. The few minutes necessary to run through it will be well spent.

The Selection and Training of Salesmen. By H. G. Kenagy and C. S. Yoakum. Three hundred and eighty pages, 5½x8 in. Published by McGraw-Hill Book Co., New York. Price $3.50.

As stated in the foreword, this volume is primarily a summary of the research on problems of sales personnel carried on from 1916-1924 by the Bureau of Personnel Research, Carnegie Institute of Technology, in which the authors took part. One is now in charge of sales research with a large manufacturer and the other is professor of Personnel Administration at the University of Michigan.

The book covers a wide range of salesmen and many industries pointing out the different problems encountered by various lines of business. It deals with the sales organization both as to field men and branch agencies; how to secure recruits for the sales force; tests for salesmen; sales efficiency and other important points.

While every business manager has a feeling that his particular problems are somewhat different from the rest, it is safe to say that there are enough suggestions that he can apply to warrant a study of the book. There are no hard and fast rules that apply to sales and salesmen, any more than to any other phase of the personnel problem, but every manager should endeavor to get as many angles on the question as possible.

History of the League for Industrial Rights. By Walter Gordon Merritt. One hundred thirty-two pages, 5x7 in., paper covers. Published by the League for Industrial Rights, 165 Broadway, New York City.

The name "League for Industrial Rights" was substituted, in 1919, for the old name of the "American Anti-Boycott Association," given an association of manufacturers formed to resist the attempts of labor unions to make use of the boycott.

This history of the league is also the history of the association. It reviews the principal industrial issues since 1902, and is both record and commentary. The present objectives of the league are explained.

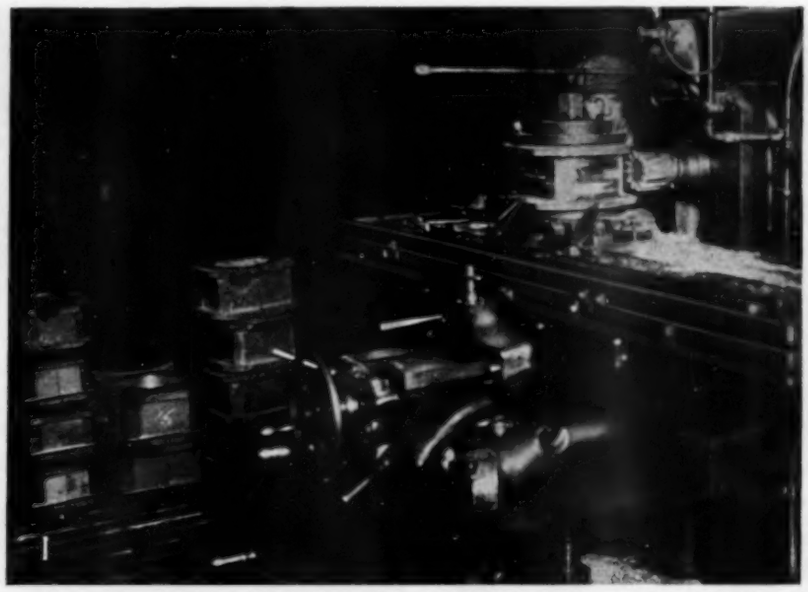
There is no individual not affected by industrial disputes and labor legislation. Hence the relative importance of a record of industrial issues, political and legislative. Beside being such a record, Mr. Merritt's book is possessed of rare "readability," due to a clear style in handling matters of extreme interest. There is every reason why it should be secured, read, and preserved.

Atlas of Traffic Maps. Prepared by Wayne E. Butterbaugh of La Salle Extension University, assisted by Charles E. Wymond, official cartographer, Central Freight Association. Twelfth edition. Board covers. The size of the book is 8½x11 in. Published by La Salle Extension University, Chicago. Price $6.

The atlas contains fifty-seven maps printed in colors and divided into four groups: general traffic, railroad association, railroad rate, and railroad system. Their sizes vary, but all are folded to fit into the book size of 8½x11 inches.

The general maps pertain to the sources of traffic and the present transportation systems of the United States as a whole. The association maps show graphically the territorial jurisdiction of the classification committees, freight associations and freight bureaus. The rate maps are devoted to freight rate adjustment. The system maps illustrate many of the class 1 railroad systems of the various sections of the country.

Among the contents of the book are a classified list of the names and addresses of railroad association tariff-publishing agents; maps of the air-mail route, automobile roads, electric railways, express blocks and zones, highway routes, navigable rivers and canals, parcel post units and zones, pipe-lines and the Ripley plan of proposed railway consolidation.



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Knee-Type Milling Machines in Railway Shops

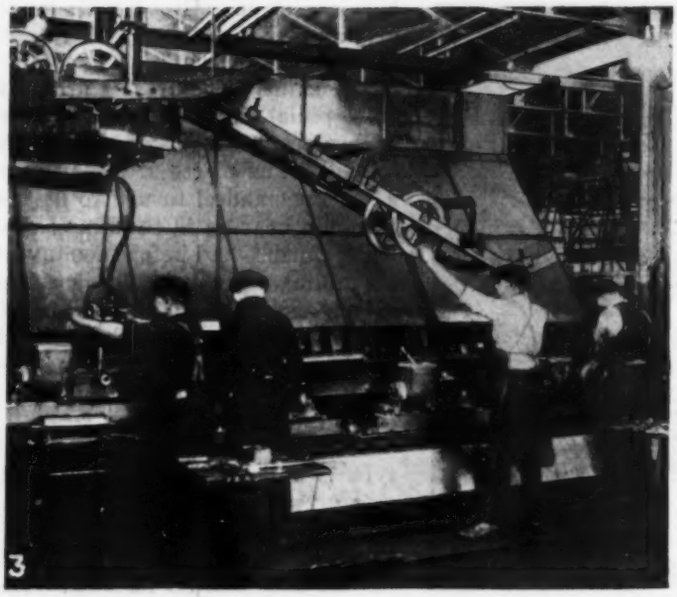
Photographs by courtesy of the Cincinnati Milling Machine Co.

ONE of the places where the milling machine makes headway slowly is in the milling of brass, especially the brasses for connecting rods. The composition of these bearings is usually such as to make a tough cutting metal and in some cases there are enough impurities to damage the cutters so that frequent grinding is necessary.

The illustration, Fig. 1, shows how one large railroad mills main driving-rod brasses on a No. 5 plain, high-power Cincinnati milling machine. The brasses are held on a special indexing fixture, a pair of brasses being clamped at each setting. The pieces are located on a central mandrel turned to fit the crankpin bearing in the brass, this being finish bored before coming to the milling operation. The cutter is a 4-in. end mill with inserted teeth. The distance across the flats is held to plus or minus 0.003 in. and the width between flanges is held to plus or minus 0.001 inch.

A steel crosshead of unusual type is milled as shown in Fig. 2, using two inserted-tooth cutters, 10 and 12 in. in diameter, respectively. The slots are 1⅞ in. wide, 3⅛ in. deep and 35 in. long. The speed is 20 r.p.m. or about 60 ft. per min. cutting speed. The feed is ¾ in. per min. full depth. The work is held on a simple fixture and is squared up by the bottom that has been finished previously. The crosshead is turned over and both sides milled in 3 hours.

Another kind of a job is shown in Fig. 3, where the inside edges of a slide valve are being milled on a No. 4, Cincinnati machine. The slide valve has been finished previously, except the ports, so that it is simply squared up on the table and held by strap clamps. The edges are milled squarely and evenly so as to give a sharp square cut off when the valve closes the port in the valve seat.



Small Engines and

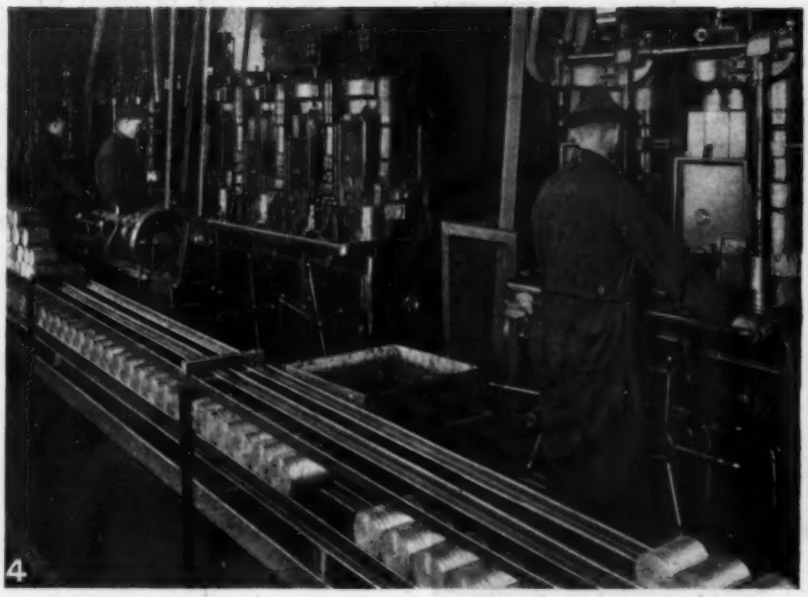
1—Milling engine bases

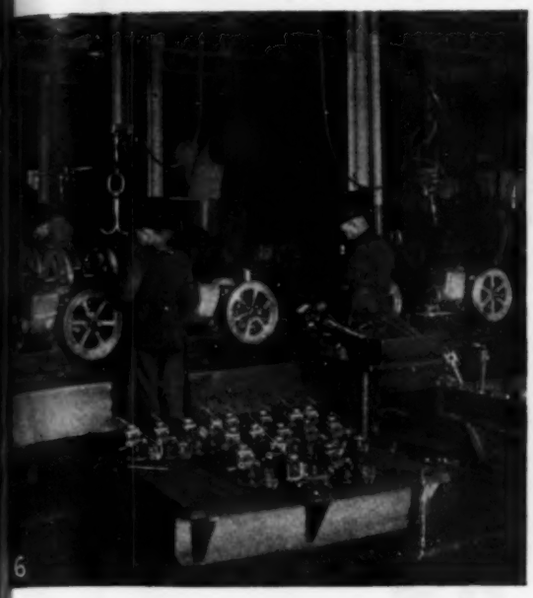
2—Conveyor to drilling machines

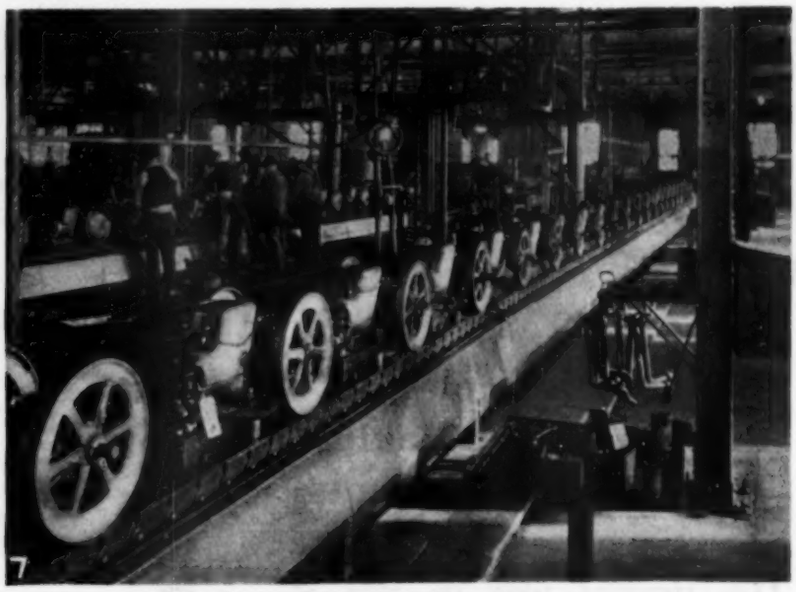
3—Fly wheels and crankshafts meet the bases

4—Automatic piston-turning machines

5—Conveyor in crankshaft department







Pumps in the Making

6—Assembling on conveyor line

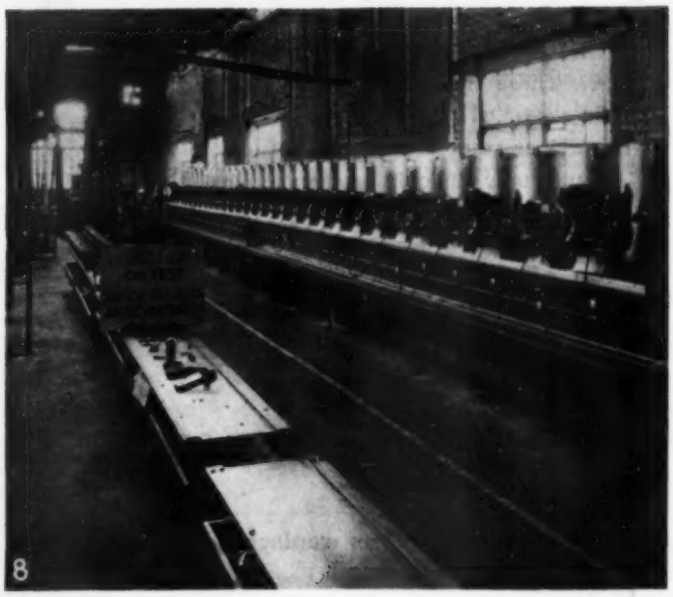
7—Ready for running test on conveyor

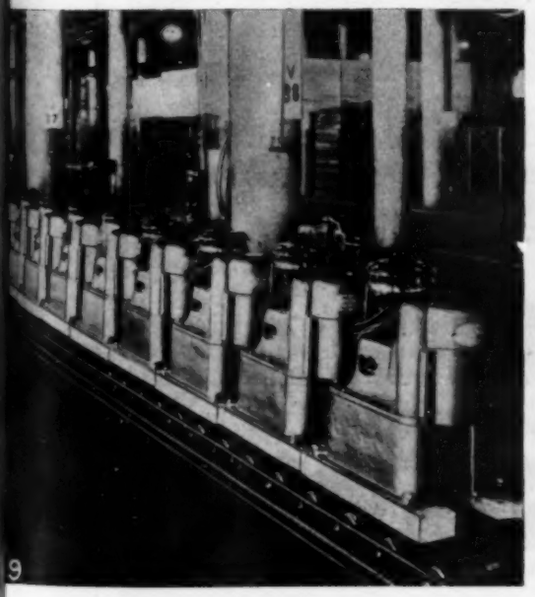
8—Home water plants on test

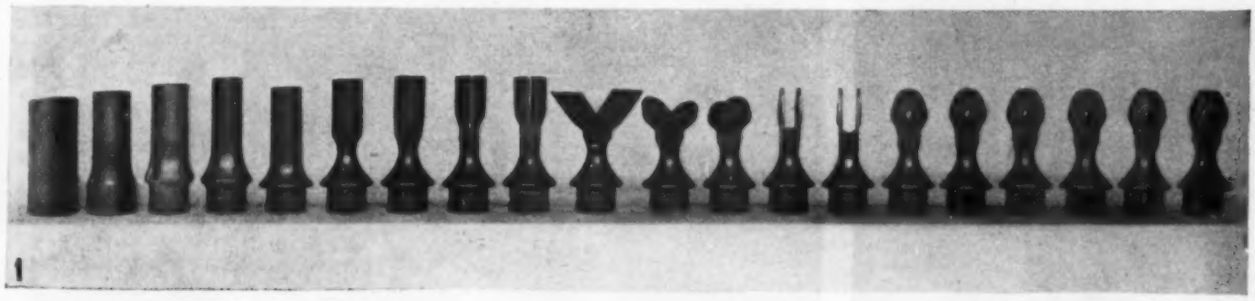
9—Deep-well pumps ready to crate

10—Shallow-well pumps in crating line

Photographs by courtesy of Fairbanks, Morse & Co., Beloit, Wis.







A Few Examples of Press Work in Making Telephone Instruments

IN FEW places have punching and drawing operations taken the place of machining operations on solid metal more than in the making of telephone instruments. These illustrations show but two specific cases. The part shown at the top in its various stages is an excellent example of an unusually difficult problem.

1—Top of telephone stand in various stages

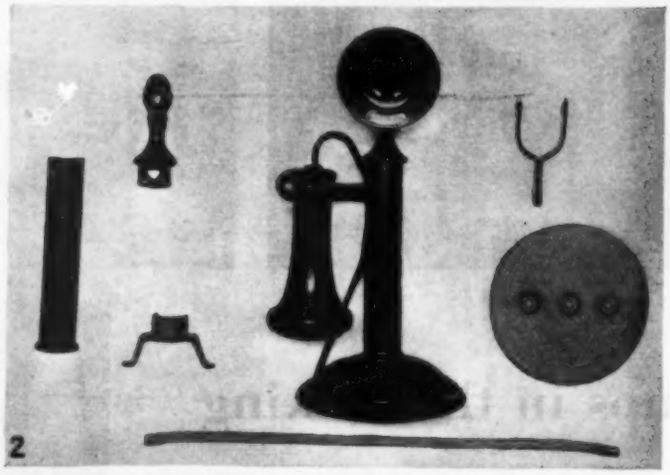
2—The instrument and a few of its parts

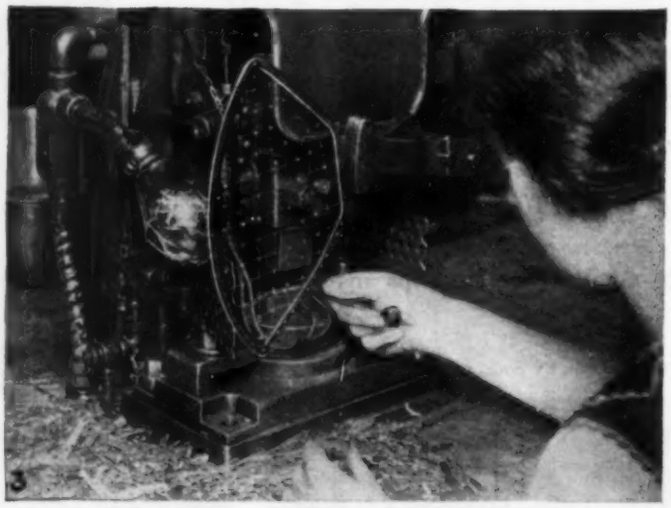
3—Guarding a small press

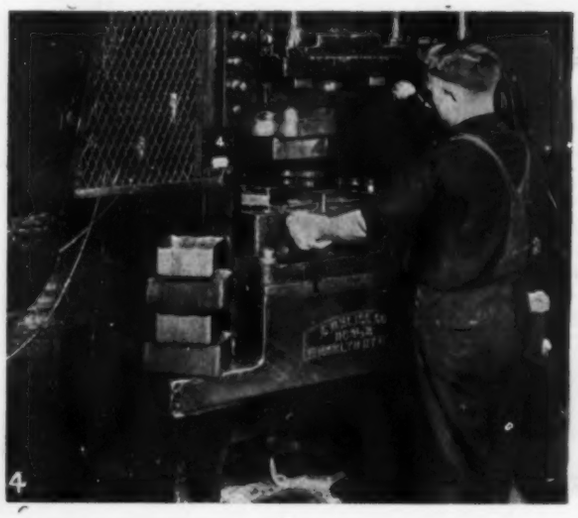
4—Drawing the bell boxes

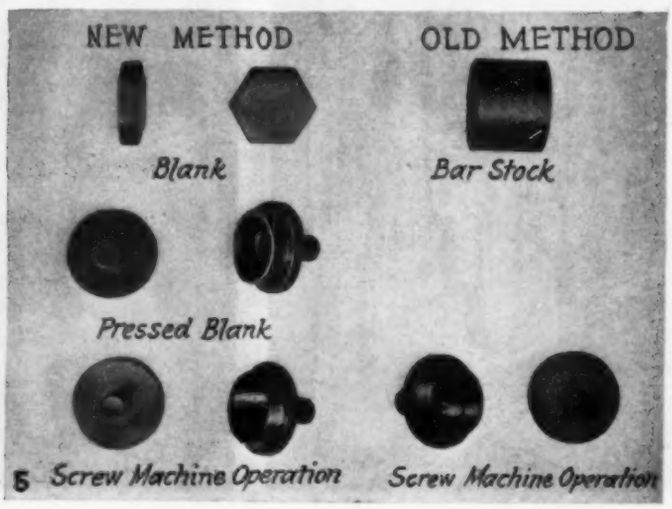
5—Where stamping has replaced bar stock

Photographs by courtesy of the Western Electric Company









"Laundering" Locomotive Air Pumps in One Hour

Fred H. Colvin
Editor, *American Machinist*

Saving idle time for locomotives and reducing cleaning costs of air pumps and all locomotive parts—Tanks and handling apparatus used

THE time that a big locomotive is idle in the repair shop costs money. Some of this loss of time is occasioned by the length of time it takes to clean locomotive parts by the old-fashioned methods. When the time for cleaning and reconditioning the parts can be cut down, the number of idle hours of the locomotive can be shortened, which means a very considerable saving to the railroad. Good cleaning methods mean not only saving time at the cleaning tank, but saving time for the locomotive, which is much more important.

This may sound very obvious, but the number of instances wherein it has apparently been customary to think of cleaning only in terms of the cleaning tank, is amazing. A fair example of such an attitude is that of a big road in the southwest, which when asked to consider the possibility of better ways of meeting its cleaning needs, replied by saying that it used only about a drum of caustic a month, and there wasn't much chance of getting a cleaning cost that was any cheaper. What the road was actually doing is told in what follows. It is significant because in many railroad shops cleaning is done, or has been done, this way because nobody had the time to think beyond the cleaning tank.

The equipment consisted of a concrete tank with a capacity of 7,000 gal. of solution. Similar tanks and methods of handling work are shown in Figs. 1 to 8. The work to be cleaned consisted of all kinds of locomotive parts, such as grease cellars, driving boxes, driving wheels, cylinders, blocks, brake shoes, etc., as well as air compressors, automatic stokers, oiler parts, nuts and bolts.

Where Steam Did the Work

By the old and usual method, the tank contained a solution of 500 lb. of caustic soda and water, all of which was kept boiling by means of a perforated steam pipe at the bottom of the tank. The work was left in the solution from two to three days and removed from the tank in about the same condition as it went in as far as the removal of the grease and oil was concerned. The work was then blown off with steam at 100-lb. pressure as shown in Fig. 6, and returned to the shop. What actual cleaning took place was really done by the steam, since the amount of caustic used was totally inadequate and had no cleaning action whatever on the carbonized and burned-on mineral oils to be removed, because a mineral oil cannot be saponified.

In the new method, the same tank and equipment are used. The 7,000 gal. of solution is made up with Oakite materials.

As a test of the new method, an old and very oily air compressor was put into the tank at 5 o'clock at night and allowed to soak without boiling until the next morning. It was then subjected to a thorough boiling out for about 2 hr. and removed from the tank. It was rinsed off with cold water from a small hose, in the same way as shown in Fig. 7, and submitted for inspection to the superintendent and others and pronounced perfectly clean. No steam blow-off was used.

In addition to the pump, oiler parts, screens, nuts, bolts, and all kinds of locomotive parts were cleaned by boiling from a few minutes to an hour in the solution, rinsed off with a hose and pronounced perfectly cleaned.

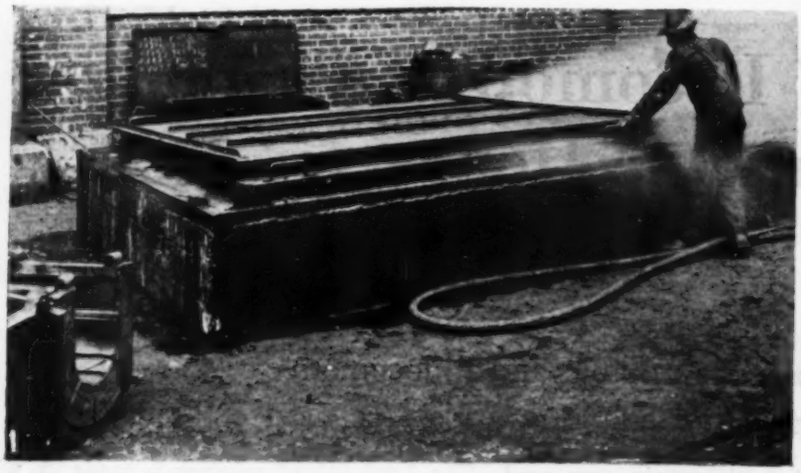
In making up a tank of new solution and also when adding upkeep, care should be taken that all of the cleaning material is thoroughly dissolved. An easy method of insuring this is to introduce the steam hose into the tank at the point where materials are added to the solution, in order to insure proper agitation until all of the material is dissolved.

Keep the Solution Agitated

When cleaning large parts, such as air compressors, automatic stokers, driving boxes, and heavy carbonized and gummed-on work, the solution should be kept boiling in order to obtain the advantage of agitation. In this solution air compressors and the more difficult work can be cleaned in from 4 to 8 hours. The best practice calls for heating by closed steam coils placed on the side of the tank, and agitation by compressed air through perforated pipes at the bottom of tank. This insures economy in cleaning materials, as it avoids dilution of cleaning solution by condensation of steam.

The use of steam to blow off the oil, as now practiced on many roads, can be entirely discontinued, the work being done by using the proper solution in the tank. After removing the work from the tank, particularly work such as air compressors, which are apt to pocket sludge and dirt, a thorough rinsing with cold water from a hose should be given to the objects being cleaned. Fig. 8 shows a lot of parts just cleaned.

Steel work cleaned with this solution will not rust, and "frozen" nuts and bolts are usually loosened by the cleaning process and will be easy for the mechanic to remove afterwards. Other advantages are that there are no objectionable or injurious fumes from the solution, cleaning is quicker and more thorough, the use of



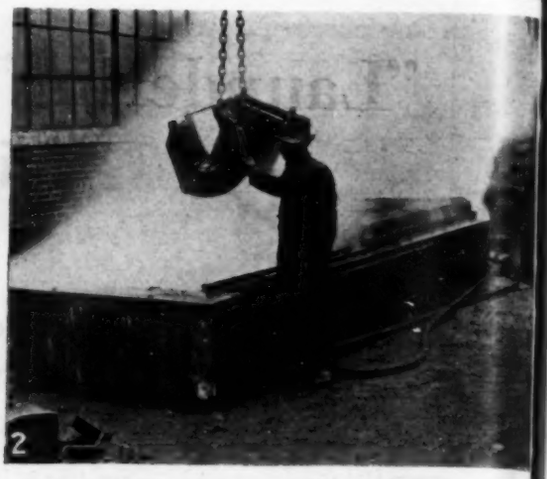


Fig. 1—Cleaning tank with sliding cover

Fig. 2—Handling driving boxes for cleaning

Fig. 3—Using air hoist over cleaning tank

Fig. 4—Lowering driving wheels into tank

Fig. 5—Holding cylinders with magnets

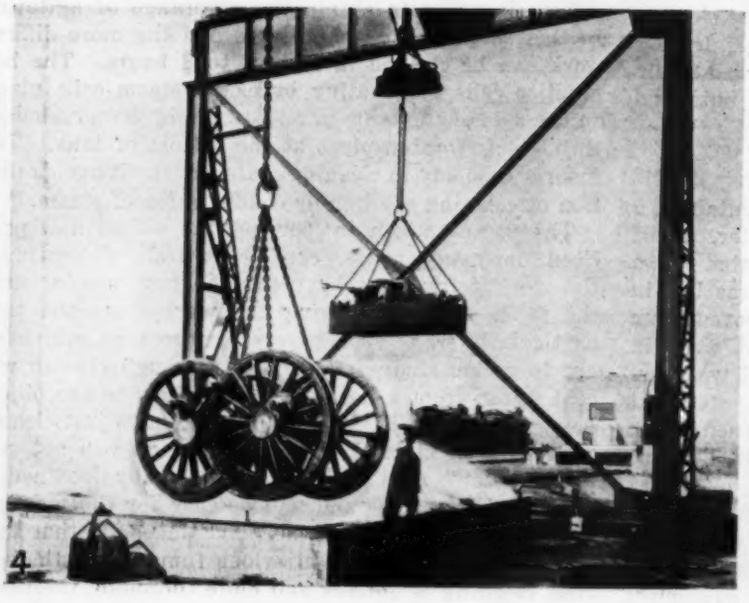
Fig. 6—Hosing-off with steam

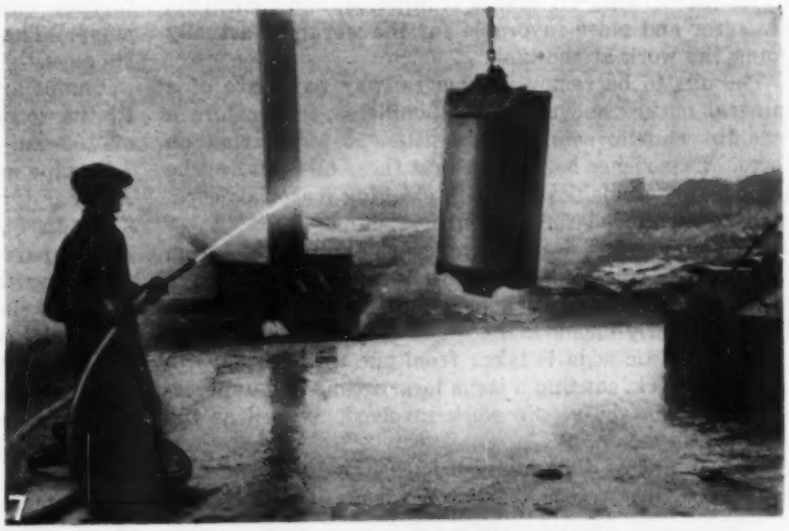
Fig. 7—Using cold water instead of steam

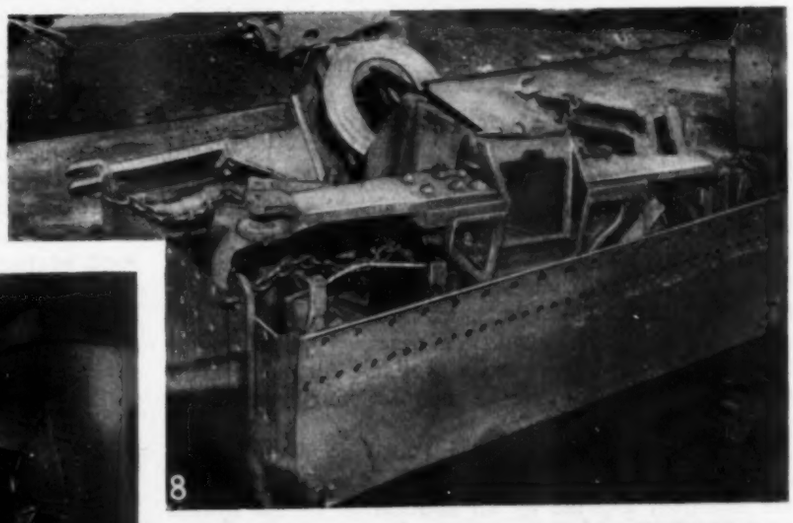
Fig. 8—After a good cleaning bath

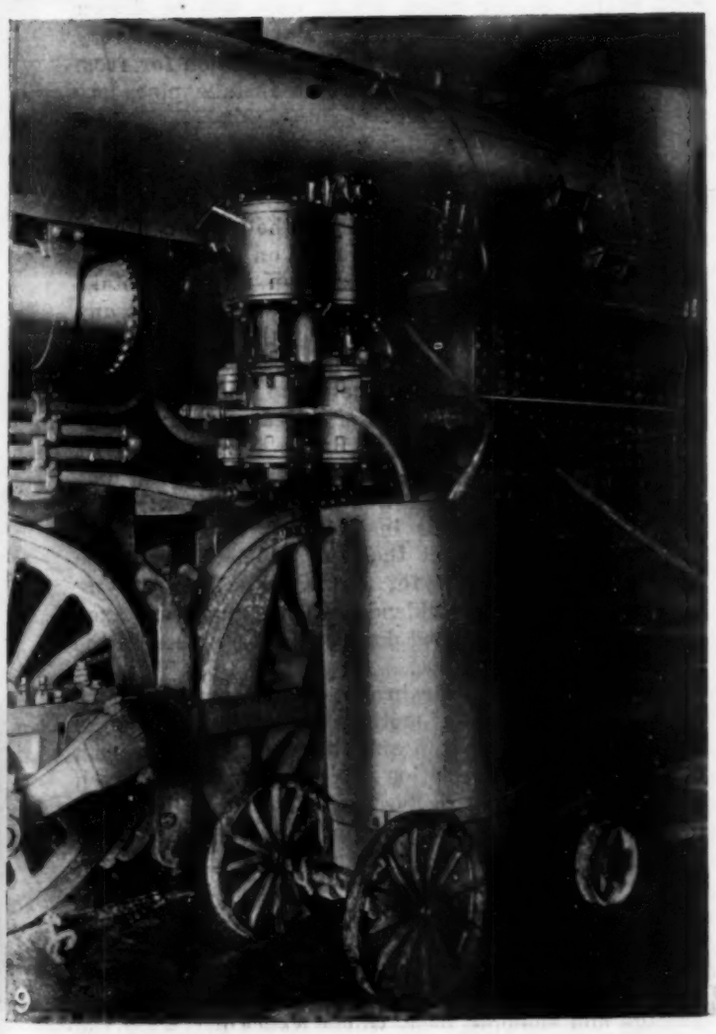
Fig. 9—Portable air-pump "laundry"

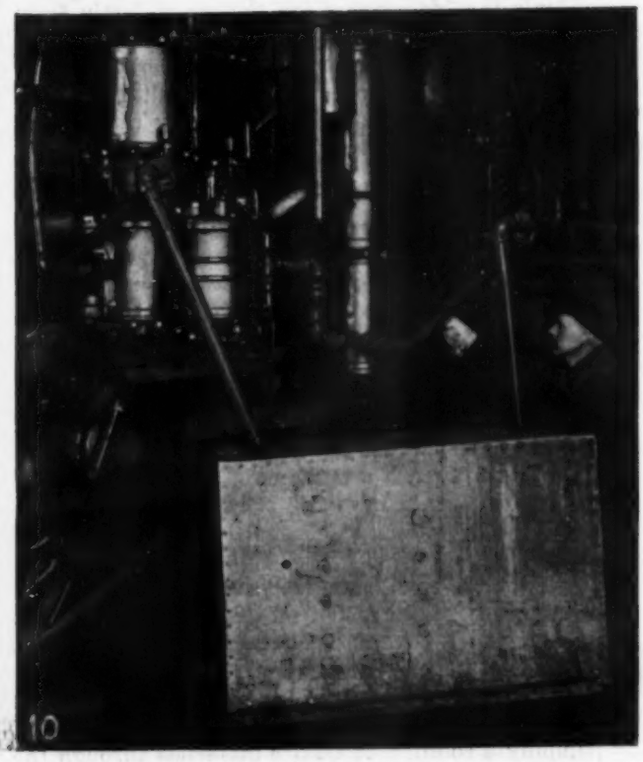
Fig. 10—Another type of "laundry"











steam for blowing off dirt is eliminated, and conditions are safer and more favorable for the workmen actually doing the work at the tank.

The oils to be removed from railway parts are of a mineral nature and are not saponifiable. Therefore a straight caustic solution has little, if any action on them. Experience has shown that these oils can best be removed by emulsification with cleaning materials especially compounded for the purpose.

By securing absolutely clean work that is free from oil, grease, dirt and carbon, the mechanic can do a better job in less time than is possible when the work is not properly cleaned.

With caustic soda it takes from one to three days to clean the work, causing a large loss of time and unnecessary delay in the repair work involved, as well as the cost of the steam.

On account of the caustic fumes, the large concrete tanks are always constructed outdoors, frequently at a considerable distance from the repair shop. Small parts from the repair shop have to be carried out to the tank and back, which is an inconvenience and takes time. It is recommended that a 500-gal. sheet-steel tank be installed right in the locomotive repair shop, as there are no fumes from the Oakite materials, so there is no reason why the tank could not be placed in the shop. Sheet-metal tanks can be welded together from steel plates, and made at little cost.

Small oiler parts, bolts, nuts, and hundreds of different locomotive parts that now have to be trucked to the larger tank outdoors, can be cleaned in a few minutes and with a tremendous saving of time and cost in a tank in the shop. This method will leave the larger concrete outdoor tanks available for the heavier cleaning, and will prove an unquestionable saving in time and labor.

We read occasionally that railroad accidents, which certainly would have resulted in terrible loss of life, are narrowly averted by an application of the brakes so suddenly that passengers are thrown violently from their seats. The air brake is without exception the most important safety device used in modern railroading. It enables the engineer to apply simultaneously to the wheels of the locomotive and of every car a force sufficient to bring the train quickly to a stop.

How the Pumps Are Laundered

The air pump—that small and rather obscure device perched on the side of every locomotive—must always be on the job. A large amount of heat is produced in compressing the air and the piston head, piston rings, valves, valve cages and air ports become coated with a deposit of carbonized lubricating oil mixed with soot, dirt and grit carried in by the air. The pump becomes sluggish in action, the valves do not seat properly and consequently the pump is not able to deliver a sufficient supply of compressed air to maintain the necessary pressure in the air reservoirs. It is imperative that it be kept in the best possible condition for performing its work.

Air pumps are now "laundered" without taking them apart, or, even taking them off the locomotive. The job is done at the roundhouse so the locomotive doesn't have to go to a repair shop. Several railroads remove the carbonized lubricating oil, gum and grit from working parts of both simple and compound air-pumps, by pumping a solution of Oakite materials through the air cylinders of the pump under its own power and thereby eliminating the necessity of dismantling the pump. The average pump requires a laundering every 30 days.

Pumps are cleaned by bringing the cleaning solution to the locomotive in a special cylindrical steel tank of 100-gal. capacity, heated by a steam coil made of ½-in. pipe and mounted upright on a truck, as in Fig. 9. Another type of tank is shown in Fig. 10. Two pipes 2 in. in diameter are led from this tank to the air intake parts of the pump. A 1-in. pipe is used for returning the solution from the discharge ports of the pump to the tank. This reduction in pipe size affords a "check" action which has been found by experiment to be quite necessary to properly fill up the interior of the pump with solution, besides affording a considerable increase in friction of the solution that facilitates cleaning. The air strainers must be removed from the intake manifolds and the discharge side of the pumps must be uncoupled from the intercooler pipes to accommodate the 1-in. return pipe.

Saving Time and Money

To 50 gal. of water in the tank add 25 lb. of Oakite materials. The solution rapidly attacks the carbonized-oil crusts and also affords a lubricant for the pump. The solution should be heated to the boiling point, and then allowed to cool slightly after boiling, since the pump cannot lift a boiling solution, due to the formation of steam in the intake pipes. If the solution is kept at the boiling point, steam only will be drawn through the pump. The pump is started and run very slowly at first. The pump is kept is operation for from one-half to one hour and then the instake pipes are disconnected.

The pump is then run a few strokes to discharge the solution inside of it back into the tank. The discharge pipe can then be disconnected, or removed from cleaning tank so that a few more strokes of the pump can blow out the remaining cleaning solution on to the ground. Hot water from a hose is then run into the intake side while the pump is still running, to rinse out any cleaning solution that remains.

The saving in cost by this method over that generally used, of dismantling the pump and boiling the parts in a tank, is naturally very great. The pump is cleaned as thoroughly as if it were taken apart. It requires a gang of three men anywhere from half to a full day to pull down and reassemble a pump. But the labor charge is insignificant compared with the loss due to the fact that the locomotive must be held in the roundhouse for a day, instead of hauling freight and earning dividends, when a pump is taken down and has to be pulled down and reassembled in the old way.

The supervisor of air brakes on one road reported to the superintendent of motive power, "The pumps are cleaned down to the iron and the surface left in such a condition that lubrication could be carried on much better than when strong lye is used. Strong lye, when used for laundering, has a tendency to produce fine pits in the metal, and lye costs about 25c. per pump, because it is not possible to boil out more than six pumps with lye without renewing the solution. With the Oakite we can boil out 25 pumps, making the cost 10.7c. per pump. The solution does not wear out to any appreciable extent and the only loss is through waste, leakage and slopping over, which makes necessary the addition of more water and therefore more material."

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Tools for Making a Ribbon Core

BY WILLIAM DENTON

The ribbon core used with the Noiseless typewriter is made from sheet steel 0.018 in. thick, and is blanked and first formed from the strip in one operation. The second operation tools fold the partly formed piece into a circle, thread the little tongue that may be seen at *A* in Fig. 1 through the hole in the other end of the piece, close down upon it the projection, *B*, that was raised upon the opposite end of the piece in the first operation and clinch them together. At the same time the ends are turned inward as the sketch shows.

The ribbon core is not a part of the typewriting machine, but is the basis of the spool upon which the ribbons are wound and must be made to fit the machine. As one of these cores is thrown away each time a new ribbon is put on the machine, the production is not

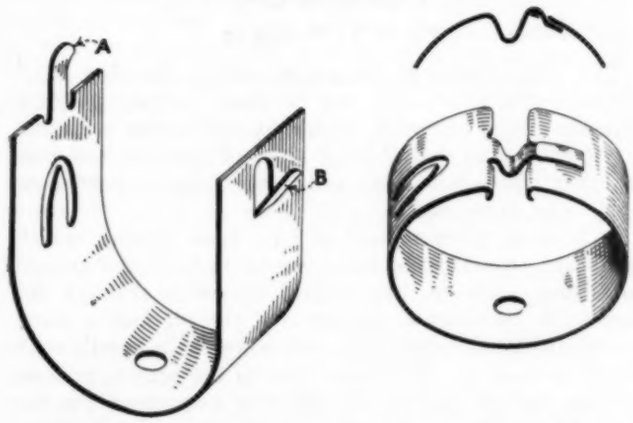


Fig. 1—The ribbon core, first and second operations

to be gaged by that of the particular machine for which the cores are intended.

The blanking and first-forming tools are shown in Fig. 2. The strip is fed in from a coil at the left and is of the same width as the piece to be made. In the first position of these tools the end of the piece is shaped as at *A* and all the holes are pierced, but the stock is not cut off. On the next stroke of the press the stock is severed and the piece formed into the U-shape to be seen at *B*, ready for the closing operation.

The hole at the end of the piece opposite the tongue is not pierced out of the metal, but is sheared around three sides, and the stock turned down into the die to leave the projection that may be seen in Fig. 1 at *B*.

In the closing operation the partly formed piece, *A*, Fig. 3, is placed by the operator upon the sliding form-

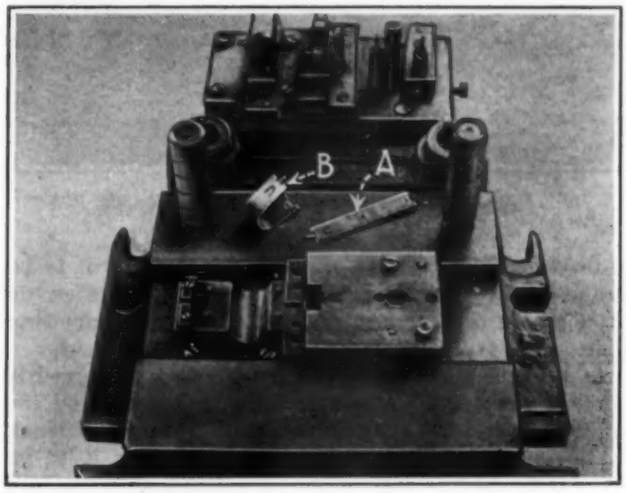


Fig. 2—The first-operation tools

block *B*, being located thereon by a short dowel that enters the pierced hole midway of the piece, and is pushed under the projecting arbor *C*. There is a small groove milled in the under side of the arbor to allow the dowel to pass.

When the press gate comes down, the first movement is made by the horizontal slides *D* and *E*, Fig. 4 (the same letters refer also to Fig. 3), which are pushed forward by the cams *F* and *G* in the upper tools; the movement wrapping the stock around the arbor *C* to complete the circle. Further movement of the gate brings the pusher *H* down upon the hinged lever *I* in the slide *D*, through which lever pressure is applied

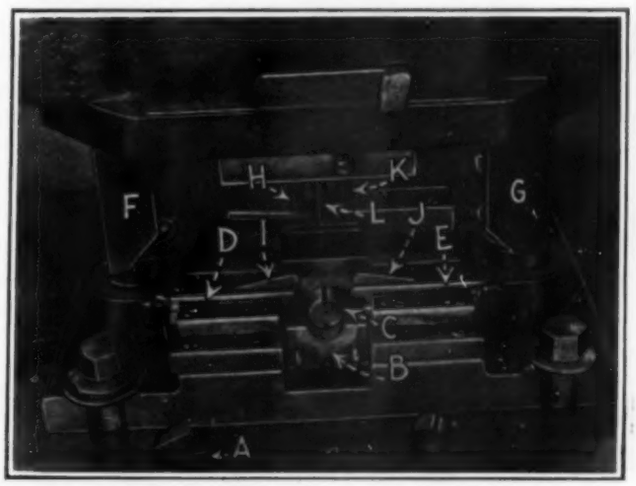


Fig. 3—The second-operation tools—open

IDEAS FROM PRACTICAL MEN

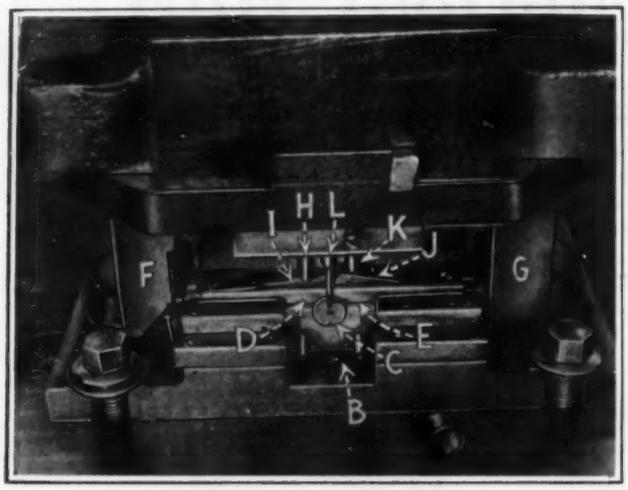


Fig. 4—The same tools nearly closed

to the tongue at the end of the blank, causing it to be wrapped still further around the arbor and to enter the space under the corresponding lever *J* in the opposite slide.

As the space into which the tongue is thus forced is too short to accommodate it, being terminated by the upturned projection that was sheared from the blank in the first operation, there is nowhere for it to go when it meets this obstruction except to turn downward and enter the hole from which the projection was sheared. At about this time pusher *K* contacts with the lever *J* and through it presses the projection back into the hole it originally occupied, and which is now also occupied by the end of the tongue.

The result of this action is that the end of the tongue where it projects through the hole is upset or riveted over inside the ring, and at the same time the sheared projection is swaged into the remainder of the opening, making a very tight and permanent lock. While these operations are taking place the forming punch *L* enters the square slot in the top of the arbor *C*, turning inward the short ends of the stock as may be seen in Fig. 1 and at the same time putting the kink in the tongue.

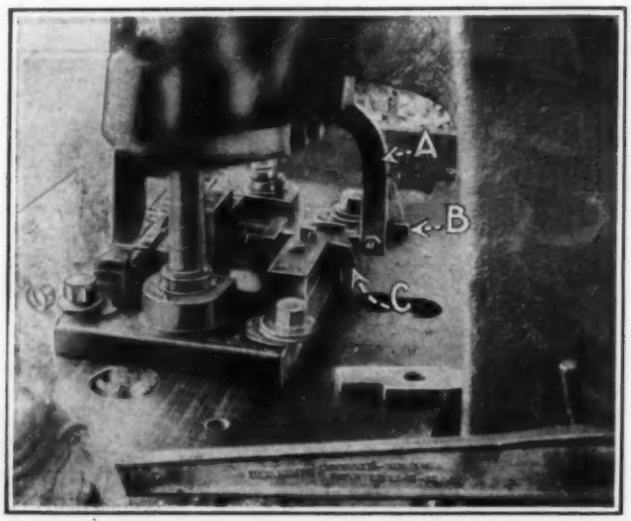


Fig. 5—The ejector mechanism

In the foregoing operation the piece is wrapped very tightly around the arbor and requires a mechanically operated ejector to release it. Fig. 5 shows the mechanism of the ejector.

The arbor (*C*, Figs. 3 and 4) slides in its supporting boss and is held normally in outward position as shown in these illustrations by coil springs. A bracket, *A*, Fig. 5, rigidly attached to the upper tool body, carries at its lower end, the spring-actuated latch *B*, which on the downward stroke of the press passes over the end of the lever *C* without disturbing it. Having reached the lowest point of its travel the latch snaps back to its horizontal position but is now under the hooked end of the lever *C*, and thus when the gate starts to rise the latch must lift the end of the lever with it.

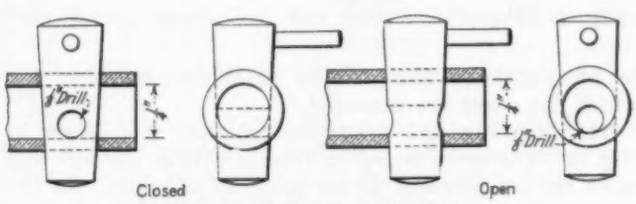
This lever is so fulcrumed that by raising the hooked end, the arbor to which it is connected is drawn back to its limit against the pressure of the springs. The work cannot recede because it abuts against the face of the boss, and therefore the arbor is drawn out of it. At the moment the arbor has reached its extreme rearward position the lever *C* has tilted so that its hooked end rides over the latch *B*, and upon being suddenly released it snaps forward and shoots the work out of the tools.

A Simple Valve for Experimental or Practical Use

By H. L. Wheeler

The valve shown in the accompanying drawing is of simple construction and can be made quickly at little expense. It is intended for use in connection with the oil or compound distributing pipes of machine tools, or in other places where an additional valve is needed to hold light pressures.

It is made from a piece of ¼-in. brass tubing, which is drilled transversely and reamed to take a standard taper pin. A ⅛ in. hole drilled crosswise through the taper pin provides a passage for the oil and a short cross-pin through the large end serves as a handle with which to turn it. The taper hole in the pipe is reamed so that the oil hole in the pin will just about cut the



Simple valve for oil pipe

lower inside edge of the pipe. The size of the oil hole is governed to some extent by the thickness of the tube wall, as in some cases a thinner wall will call for a smaller hole if the valve is to be tight when closed.

A valve of this kind possesses the advantage that it may readily be placed in any part of the pipe line, and it may save time that might otherwise be expended in cutting the pipe, or the expense of a more elaborate fitting.

IDEAS FROM PRACTICAL MEN

Locating Holes to Be Drilled at an Angle

BY ALFRED T. GREGORY

In Fig. 1 is shown a bar to be used as a part of a drilling jig, in which the holes must be located with extreme accuracy both as to center distance and angular disposition. The method employed to locate and bore the holes is shown diagrammatically in Fig. 2, the work being done in a milling machine equipped with a universal vise.

Before setting up the work in the machine, the centers were laid off on the bar and prick-punched as

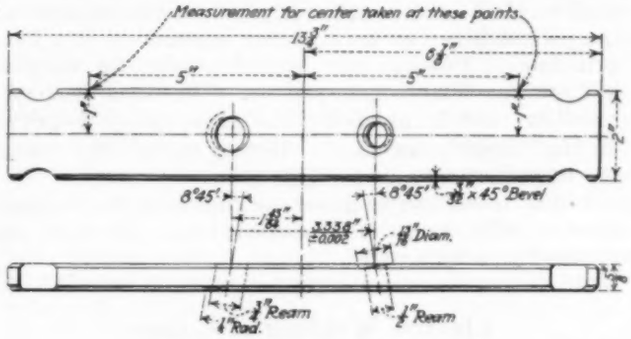


Fig. 1—The bar to be bored

accurately as circumstances would permit, these preliminary marks being used as aids in the set-up. The bar was then clamped midway of its length in the vise and by means of an indicator held in the spindle of the machine, the face of the bar was made perpendicular to the center-line of the spindle by adjusting the universal vise. The bar was also set horizontal by the same means.

Next, a bevel protractor was carefully set to the required angle and clamped to the face of the bar by means of a parallel clamp. The vise was then adjusted so that the indicator would read zero while passing over

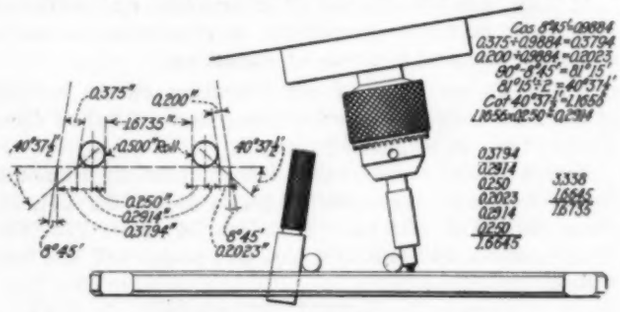


Fig. 2—The set-up in the milling machine and the computations necessary

the full length of the blade. A "wiggler" was then put into the chuck and the table of the machine adjusted to bring one of the prick-marks into alignment with the spindle.

After the first hole was bored and reamed, the protractor was again clamped to the bar but with the angle in the reverse direction and the bar set by the same means as before to bore the other hole, but without disturbing the vertical setting of the machine table. Before proceeding to bore the second hole some calculations were necessary.

A piece of drill-rod or other bar of steel was inserted in the drill chuck and to the squared end, a toolmaker's button was attached and trued up accurately by means of an indicator on the table of the machine. With a plug gage in the hole already bored and the button brought close to the bar, two rolls were placed as shown, and secured by elastic bands.

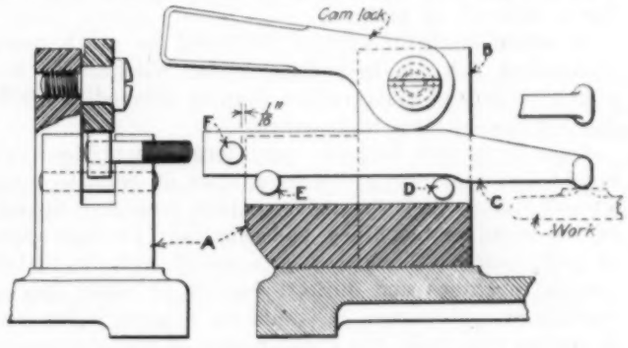
The calculations required to determine the distance between the two rolls is shown in Fig. 2, and this distance was checked by means of Johannson blocks, moving the table of the machine back or forward by means of the traverse screw as necessary to secure it.

Accurate as are the requirements of this job, it will be found easy to meet them by this method. One thing should always be borne in mind, and that is that the machine graduations should never be depended upon.

An Efficient Clamping Device

BY FRANK WALDO

The greater majority of jigs and fixtures require some sort of a clamp for holding the work in position. An observation in a production shop would show that a surprising variety of designs and styles of clamps are used, incorporating many principles. Very few con-



A rapid-action clamp for fixture work

cerns have given any thought to the standardization of clamps, yet it is possible to arrange three or four designs, flexible enough for the average class of work. As an example, the clamp illustrated can be adapted to many classes of work. It is comparatively simple in construction and is inclined to be fool proof, inasmuch as it will work only when in the right position. It can not come out of the body, due to its construction. It is rapid to set in place. No springs are required to raise it from off the work, since the cam portion *C*, striking on pin *D*, takes care of this movement as the clamp is drawn back. There are no swinging members. It allows easy removal and loading of work. It is easy to clean and its operation can not be affected by chips. In operation, the clamp is forced as far forward as possible so that the pin *F* strikes the end of the body *A*. In this position the clamp locates on pin *E* as will be seen.

Some of the features can be modified for use in other devices. While as shown, it is used on light work, it can be made suitable for work of any class.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Grinding Steel Balls

Q. Will you tell me how steel balls are held while being ground? We use a considerable quantity of steel balls and at present have to wait from two to three weeks for special sizes, whereas if we could build a special machine to take care of finish grinding, we could use stock sizes and regrind them to the sizes we require.

A. Steel balls are ground in a special machine in which a number of balls are revolved in a V-type raceway. Pressure is applied by the weight of a heavy head covering the raceway and resting on the balls. Oil and abrasive are fed to the balls. The grinding operation is entirely automatic, since the balls present all of their surfaces to the raceway at some parts of their travel and, there being more or less slippage, they undergo a continual abrading action.

The machine is stopped from time to time and a small percentage of the balls removed and gaged. If they are not to size, they are put back and the grinding is allowed to proceed.

It would seem to us that it would be much more economical for you to redesign your machine to use standard sizes of balls, rather than be delayed by waiting for special sizes to be made.

Unless you use balls in very large quantities, you would find regrinding standard sizes of balls to your special sizes a very expensive matter, since the upkeep of the grinding machines, and especially the raceways, is quite costly. Then, too, you would have to install gaging machines and quite a variety of other special equipment. Moreover, it would be necessary for you to design and build the greater part of the equipment. To do this would require an intimate knowledge of the whole process of ball making.

A Problem in Polishing

Q. I have some steel rolls on which I want to get the best possible polish. In fact the ultimate in polish is desired, the cost being of secondary importance.

The rolls are 3½ in. in diameter. They are ground on a precision grinder and then polished with a fine-grit stone. Could the ultimate in polish be obtained by lapping in a lathe, or is there a better method? If lapping offers the best solution, what abrasive should be used and of what material should the contact surface of the lap be made?

A. In putting a super polish on the rolls referred to, the first thing is to get the best possible finish by grinding. Sometimes an extra good grinding finish can be obtained by a second grinding operation, using a hard, fine wheel and applying a few drops of lard oil. If you try this, we should advise grinding with very light pressure so as to keep down the heat.

Having the best possible grinding finish, the rolls should be lapped in a lathe, using an adjustable, or compressible, lap lined with lead and charged with No. 180 abrasive. After lapping, a good polish can be secured in one of the two following ways:

A rag buffing wheel charged with crocus can be used in place of the abrasive wheel on the grinder, or the polishing can be done by the application of a fine-grit stone. Possibly the best stone for the purpose is known as Water of Ayr stone. This stone was successfully used in obtaining the super polish required on the recuperators of the 75-mm. guns, upon which the inspection was very rigid.

A final luster can be given the rolls by a fine chamois charged with rouge and applied while the rolls are revolved at a high speed.

Electric Welding of Copper

Q. In reading the American Machinist *I have failed to find anything on the electrical brazing or welding of copper. Is it possible to weld copper on a standard type of welding machine?*

A. There is no difficulty whatever in electrically welding copper on any of the standard types of welding machines.

In 1920 there was published in the *American Machinist* a series of articles on both gas and electric welding, by Ethan Viall. The series ran nearly through the whole year.

Industrial Diamonds

Q. Can you advise me of a treatise on industrial diamonds, particularly relating to structure, comparative hardness and methods of mounting.

A. We do not know of any literature on the subject of industrial diamonds, other than that published from time to time in technical journals.

You will find considerable information on diamonds in the *American Machinist* on pages 49 and 94, Vol. 48; page 1092, Vol. 53; page 789, Vol. 54; page 773, Vol. 55; pages 53, 140 and 210, Vol. 56; pages 437 and 949, Vol. 57.

Making Threaded Shells

Q. Can you tell us how the threaded shells used in electric-light sockets are made?

A. The manufacture of threaded shells for electric-light sockets requires two comparatively simple operations. Sheet metal is first blanked and drawn to shape and then the threads are formed in a thread-rolling machine.

Of course the dies for blanking and drawing, as well as the rolls for threading, will have to be especially made for the particular shell you wish to produce.

Technical Abstracts

Computation of Labor Turnover

There are so many ideas on the method of figuring labor turnover that this brief article will help to clarify the situation. Labor turnover is the fluctuation in the personnel of an organization. The extent of it in any establishment is roughly indicated (indeed under certain conditions it is quite accurately indicated) by the ratio of the number of accessions to (or of separations from) the work-force during any given period to the average size of the work-force during that period. The average size of the work-force is reflected in most establishments with sufficient accuracy by the payroll figures. In establishments where daily records of attendance are kept, this will serve better than the payroll because the number of accessions is simply the total number of persons taken on during the period and the number of separations is the total of those who leave, no matter for what reason. There are short periods during which vacancies caused by separation remain unfilled, but the tendency is strongly towards a balanced equality between accessions and separations. These balanced, replacement fluctuations, which comprehend all of the fluctuations experienced by any establishment under the conditions just mentioned, are the sort of fluctuations in which the employer is chiefly interested. In other words, the employer is concerned most of all with the amount of shifting and replacement necessary to maintain his normal personnel. This is his turnover problem.

Paul F. Brissenden, School of Business, Columbia University, the author of this article, gives an equation $t = \frac{s - e}{n}$, in which t represents the rate of turnover per worker on the normal force, (s) the number of separations during the period, (e) the excess of separations over accessions and (n) the average number of employees on the working force during the given period, or in other words, labor turnover is the net number divided by the normal number of men on the pay roll. —*American Management Review*, April, 1925, p. 114.

Pyrometry

H. A. Schwartz, manager of research, the National Malleable & Steel Castings Co., Cleveland, gives this paper that touches upon the many phases of the problem of measuring temperatures that are considerably above room temperatures. The developments of the art of pyrometry and the methods of determining temperatures are discussed in some detail and very fine descriptions of the radiation type, the thermocouple and the optical type of pyrometers are given.—*Transactions of American Society for Steel Treating*, April, p. 518.

Technical Education in England

The associations and technical institutions in England recognize that the time has come when the position of technical education ought to be reviewed. There is a growing belief that technical and scientific education must do more for the student than merely provide him with the tools of his vocation, and there is a feeling that such an education should be liberal so it may open and broaden the mind and add that refinement of feeling without which education can never become cultivation, due to short working hours—several hours of leisure have already been added to the week, and the tendency is for working hours to grow less and less. Formerly work was not merely an incident in the twenty-four hours, but today there are many crafts in which work is physical drudgery, manual skill is now reserved for the few, and for many labor is a long monotony of repetition. While this motion is taking place among workmen themselves, it involves those immediately above them, the charge hands and foremen, and spreads in many cases to the managers and directors. For this reason the problem of the future is a problem of leisure, and vocational education alone will not broaden our interests or enlarge our imaginations to take care of existing conditions.

It is stated that in England at the present moment the attempt is made to teach too much. The student is required to study intimately too many subjects, and what is desired is a very thorough grounding in certain selected subjects and a broad knowledge of others. Examinations are the bane of education. As a test of real competence they fail hopelessly. However, there seems to be nothing else to take their place. It is stated that not more than 5 per cent of the students are worth the money spent on them.—*The Engineer* (England), April 17, p. 437.

Some New German Lathes

Otto Lich describes some new German lathes, the principal features of which appear to be automatic stops of very high accuracy and turrets holding six tools. The Loewe high-speed lathe is described in detail. The main element of the stop mechanism here is a releasing worm-feed drive, which is disengaged by the stops. The firm Boehringer Brothers has brought out a new so-called Stellite lathe, the main spindle of which makes 800 r.p.m. By some very well developed change wheels the speed of the faceplate can be varied from 25 to 800 r.p.m. in fifteen steps. Another interesting new development of the same firm is a direct-driven lathe, the motor of which has a hollow armature, so that its axis is concentric with that of the headstock. By weakening of the field one speed of this motor can be increased in the ratio of 1:3. Gears provide eight steps, so that there are twenty-four speeds in all. There is a brake on the motor which makes it possible to stop it, and also to reverse it immediately. A diagram shows in a very simple manner how to throw the operating levers so as to attain any desired speed.—*Die Werkzeugmaschine*, Feb., p. 98.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

No One is Always Right

THERE is a motto in some merchandising houses to the effect that "the customer is always right." In other words, the customer not only receives the benefit of a doubt, but even more.

This may be good psychology in retailing dry goods and powder puffs, but we are inclined to doubt it even there. Neither side is always right and every customer knows that when a merchant loses money in any transaction, whether it is his fault or not, he must make it up on other customers.

It is even worse, however, for the manufacturer to assume that he, or his organization is always right. And still more disastrous to assume the attitude that mistakes are impossible because of one's long experience and excellent reputation.

A case in point is where a certain large user of instruments received one that was incorrectly graduated. Not a mere error beyond the usual tolerance but an entirely wrong marking on the dial. Even the purchaser could hardly believe his eyes, but, after convincing himself that it was not a case of mental aberration on his part, he wrote the maker in a friendly manner, calling attention to the error.

Without waiting for the instrument to be returned, the maker wrote a sarcastic letter stating that he had been making these instruments for many years, that they had a world-wide reputation and waxed eloquent over the quality of the product. He wound up by stating that their shop could not make such an error and that it would be impossible for it to escape the inspection department, if made. He even intimated that the customer might be in need of mental treatment to imagine that such an error could be made in their plant.

When the instrument came back, however, they found the impossible had actually happened, even though no one could explain it. A new instrument was promptly sent to the customer, and if it had not been for the letter that had been written, all might have been well. But the claim of infallibility in the face of a flagrant error and the attitude of the reply had "cooked the goose" for that product. It was crossed off the preferred list and a competitor now gets all the business.

Mistakes do happen in spite of all precaution. Sometimes it is on one side and sometimes on the other. And each side should pay for its own mistakes, for neither is always right.

A Queer Inferiority Complex

THE inferiority complex is a comparatively recent discovery of the psychologists. Its manifestations are often strange indeed.

No queerer case has come to our notice than the obsession that seems to grip American manufacturers and even engineers to the effect that discoveries made by Americans must be deprecated but are hailed with acclaim when re-discovered by foreigners. Most of us can probably recall several cases of the sort if we stop to think about the question.

The Klopstock lathe tool described in a paper before the American Society of Mechanical Engineers at the Spring Meeting just ended is a beautiful example. An identical tool was invented by an American engineer and described in a paper before the same society some eight years ago. No attention was paid to it. Now comes the same thing with a foreign name attached to it and the populace bares its collective head in awe of the great achievement.

We have no intention to reflect in any way on the German re-discoverer. He did a lot of useful research. But that he knew something at least of the work that had been done in this country years ago is evident from the fact that he borrowed a graph from the original paper. Apparently he knew the psychology of his audience and believed that Barnum was right. Who shall dispute him?

Just Suppose

JUST suppose you hired a man for your shop who had a fine collection of tools and machines which he brought with him and placed at your disposal, thus materially increasing the capacity of your factory. Wouldn't you pay him something extra, something above the standard rate of wages, and wouldn't you make a strenuous effort, expressed in dollars and cents, if he showed an inclination to leave?

Now suppose you hire a man for your shop, and you find that besides a pair of hands and a set of muscles, he has also a lot of experience, a keen brain, inventive ability and vision. Do you go to that man and say: "My boy, you are much more than I thought you were, and in justice to you, and for the comfort of my conscience, I'll have to double your wages, give you an occasional bonus when you do the unusual thing and make it so pleasant for you that you would swear at the fellow who suggests a change." Would you?

Well now, why should I be a fool like that so long as the man seems satisfied with what he gets?

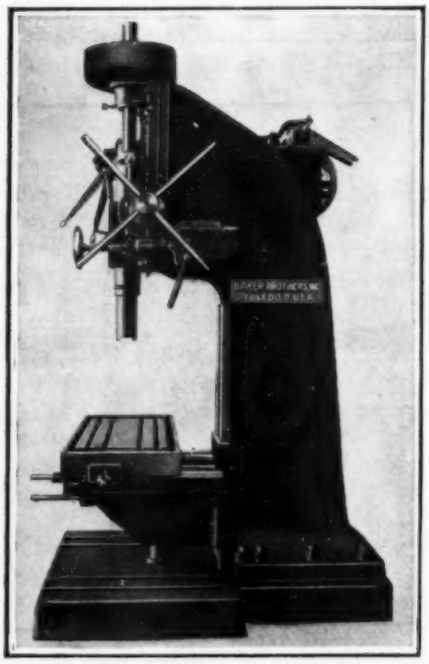
Would that be foolish? Well, perhaps, but—

Just Suppose.

Shop Equipment News

Baker Heavy-Duty Vertical Boring and Drilling Machine, Nos. 425 and 525

For the drilling and boring of heavy work such as large machinery, engines and railroad work, Baker Bros., Inc., Toledo, Ohio, have brought out a heavy-duty machine, made in two models, Nos. 425 and 525. These machines are larger and heavier than the models No. 416 and 417 that they supersede and have refinements and improvements that afford greater flexibility and larger clearance dimensions.



Baker Heavy-Duty Vertical Boring and Drilling Machine, Nos. 425 and 525

One of the features of these machines is that the spindle sleeve bearing is capped so that wear can be taken up, assuring alignment and rigidity of the spindle at all times. On heavy work, such as handled on these machines, there is a strain and feed thrust against the forward half of the spindle-sleeve bearing causing the wear that may occur to be entirely on the cap and by the provision of this adjustment, such wear can readily be taken up.

All operating levers are placed in front of the machine so as to minimize the work of the operator in changing speed, feeds and table adjustments. The starting and stopping of the machine is also made from the front by a lever located in an accessible position. A simple form of speed drive provides eight speed changes to be made without stopping the machine. Twelve drilling and twelve reaming feeds are provided. An automatic depth stop for facing to an exact depth is possible by the application of a special pair of feed change gears. The spindle is of the forged type, bored for No. 6 Morse taper, slotted across the end for driving heavy boring heads, fitted with a cross drift for holding tools securely and is provided with a hollow set screw to prevent light tools from dropping out.

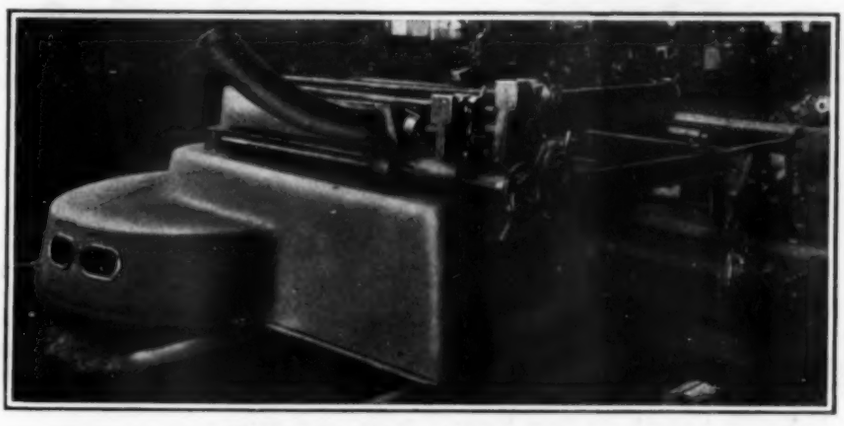
The table is of the box-knee type, operated by a telescoping screw and reinforced so that a four-inch hole may be bored for supporting a boring bar of that size if required. The compound table is adjusted by a screw having a lead of 1 in. to the revolution. Micrometer collars provide for accurate adjustments to be made.

Some of the specifications of the Nos. 425 and 525 machines are: Capacity 4½ and 5½ in., distance from center of spindle to face of column 18¼ and 21 in., distance from end of spindle to compound table 31 and 38 in., spindle-sleeve diameter 5¼ and 6¼ in., feeds per revolution of spindle 0.005 to 0.096 in. and 0.006 to 0.108 in., speed range 32 to 272 r.p.m. and 11 to 151 r.p.m., net weight with plain table 6,700 and 9,200 pounds and net weight with compound table 8,000 and 10,800 pounds. A drive of 15 hp. is required for operating both types of machines.

Federal Bending Machine, Type F

The present line of pipe bending machines manufactured by the Federal Bending Machine Co., Bayonne, N. J., has been increased by the addition of the type F bender illustrated, containing several improved features and capable of making bends efficiently and at a low cost.

This machine is intended for the bending of pipe ranging from 3 to 8 in. in diameter, extra heavy, making the desired bend without heating or filling. In operation the pipe is inserted in two clamping blocks operated by lead screws. Two heads are adjusted to suit the radius of the bend desired and locked by set screws, after which tie rods are tensioned so as to take some of the forces developed during the bend and distribute them between the main spindle and the heads. The power



Federal Bending Machine, Type F

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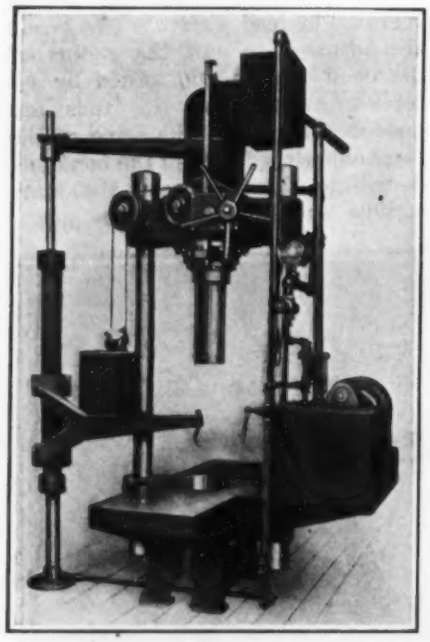
is then applied, causing the main spindle to swivel, carrying with it a former and a revolving arm. The pipe being stationary to the spindle is bent until the power is shut off by an automatic stop, adjusted at any desired position. The straight section of the pipe is held in position with the slide block, relieving the pressure between the pipe and the resistance head. It is necessary to reverse the motor a trifle, when the bend is completed, to bring the revolving arm back 10 deg., lessening the recoil of the pipe against the clamping heads.

When the bend to be made has a radius six times that of the pipe diameter it is necessary to use a mandrel. The photograph given shows a pipe with a bend in an upward direction. The bend produced by the machine is not made in this direction, however, but at right angles to it and at the other side of the clamping blocks.

Hydraulic General-Purpose Press

The vertical hydraulic press illustrated, adapted for general machine-shop work, has been marketed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This style of press is made in several sizes, the one shown being 100-ton capacity. The pressure bed is provided with a central hole so that it can be fitted with bushing plates, and by the use of fixtures and tools can be adapted for forcing, bending and straightening operations.

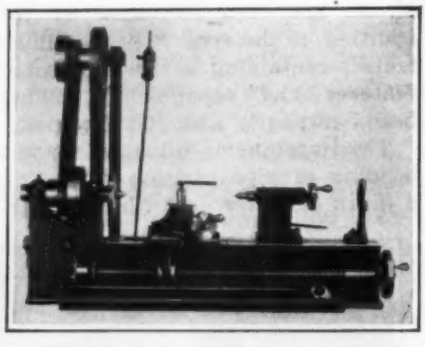
A self-contained pump that may be either belt or motor driven operates immersed in the pressure fluid, this fluid being oil. A surge tank on the top of the press serves as a reservoir for the slack water that fills the pressure cylinder when the ram descends to the work. Rapid movement of the ram is produced through a rack and pinion drive by the turning of a spoked handwheel. A feature of the press is the hydraulic hoist operated by the pump, and its movement is controlled by a single valve. It will lift parts up to one ton in weight and is so mounted that work can be swung from the floor to the center of the pressure bed. The press is useful in railroad shops for bushing various classes of work and for the straightening of locomotive side-rods, as well as for use in malleable iron and steel foundries for straightening castings.



Hydraulic General-Purpose Press

Carroll "Just-Rite" Lathe, 10 x 24 Inch

A number of improvements have been made in the "Just-Rite" lathe, manufactured by the A. V. Carroll Machine Tool Co., Highland Ave., Norwood, Ohio.



Carroll "Just-Rite" Lathe, 10x24 in.

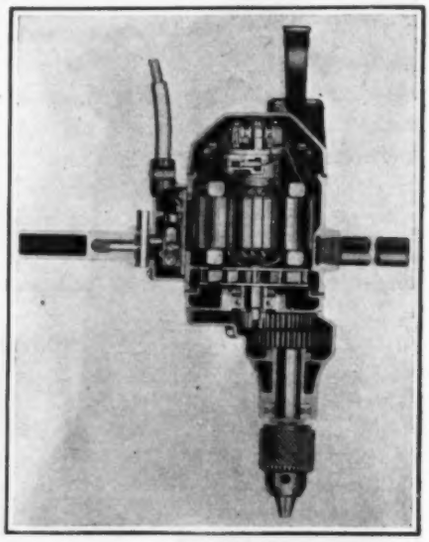
This machine is equipped with a hollow spindle, provided with a $\frac{3}{4}$-in. hole, a set-over tailstock with self-discharging centers and a special type swivel rest that is adjustable to long ranges by removing a hex-head screw and adjusting to the second or third hole in the top of the carriage.

The countershaft is mounted on a $1\frac{1}{4}$-in. post, fitted to an extension support that is cast on the bed. The motor is fastened to a built-in mount, making the machine a self-contained unit.

The length of the bed is 38 in., the width $5\frac{1}{4}$ in., and the maximum distance between centers is 24 in. The net weight of the machine is 180 lbs., and boxed for shipment is 230 lbs. The equipment includes endless belt, cord and socket connections, motor, face plate, centers and necessary tools.

Hisey Universal Electric Drill, $\frac{1}{2}$-Inch

An addition to the present line of electric tools manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio, has been made by the inclusion of the half-inch universal drill illustrated.



Hisey Universal Electric Drill $\frac{1}{2}$-Inch

The motor of this unit is of the single-purpose type, built especially for electric-drill service with a hand wound armature and stator. Forced ventilation is applied to the commutator and motor by a balanced fan fastened on the armature shaft. Ball bearings are used for mounting the armature shaft and arranged so that they can not slip as the inner races are locked. The gear-end bearing is mounted with a floating fit in a hard cast-in sleeve. The chuck spindle is hardened and ground, and is automatically lubricated through the gear case. The usual type of Hisey push switch is used, conveniently located in one of the side handles.

This drill is supplied for either

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115 or 220 volts and is equipped with a ¼-inch Jacobs drill chuck, 10 ft. all-rubber Tirex cable and a suitable attaching plug.

Danley Lapping Device

An improved form of lap has been developed by the Danley Machine Specialties, Inc., 4909 Lincoln Ave., Chicago, as shown in the illustration. These laps have been designed for producing accurate work, to be

Danley Lapping Device

quick in use and to be economical in labor and material.

One end of the arbor is provided with a tapered thread and locking unit that cannot work loose under vibrations. Copper laps of the spring type are used in connection with this device, and these may be obtained in sets of three or separately.

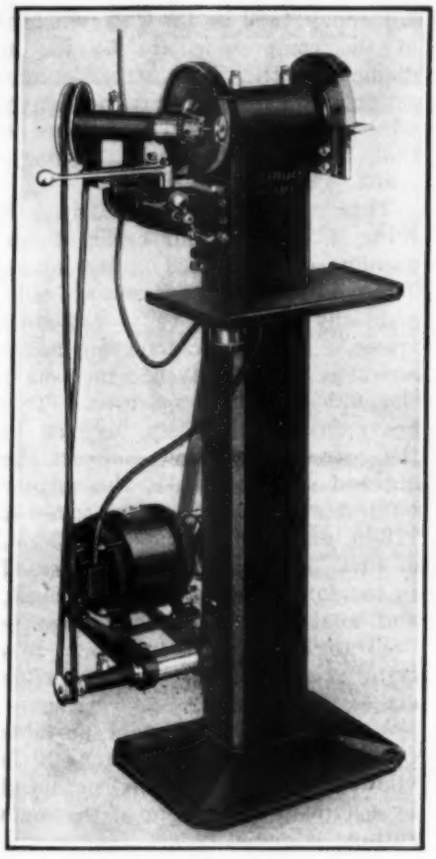
These laps are made in three sizes. The smallest takes sizes from ½ to ¾ in. and is equipped with a No. 1 Morse taper shank, the next size is applicable for sizes from ¾ to 1¼ in. with a No. 2 Morse taper and the largest adapted to sizes from 1¼ to 1¾ in., also having a No. 2 Morse taper shank.

Imlach Grinder for Garage Use

To meet the need of a grinding machine for garage use, John S. Imlach, Ottawa, Canada, has developed the machine illustrated. It is intended for the grinding of valves, chisels, drills, scrapers, and general-purpose work of the usual type, accomplished in the garage.

This machine is self-contained, having a motor drive attached to the base, permitting installation in any location. A vertical adjustment is provided for the work head so that valve-seating cutters can be resharpened with a proper clearance angle.

Double-taper work-spindle bearings are used so that the end and



Imlach Grinder for Gcrage Use

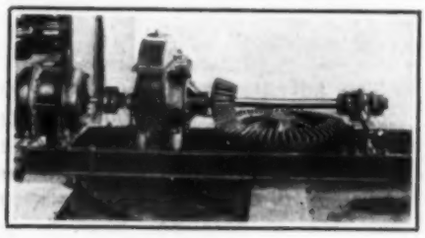
radial adjustments can be taken up. The bearings are of the self-oiling, dust-proof type, ¾x2¾-in. The work-head slides are of sufficient length to cover the lower slides, insuring them against grit and dirt. Two 6-in. grinding wheels, ½ in. and ¾ in. face are furnished. No idlers are required for the driving belt as the motor is hinged on a bracket. so as to utilize its weight as a tension, being moved outward or inward according to the pressure desired.

Hill Spur-Gear Speed Transformer, Industrial Type

The Hill Clutch Machine & Foundry Co., Cleveland, Ohio, have developed an industrial type of spur-gear speed transformer for the service as is encountered in connection with conveyor drives, steel plants, refineries and in general industrial works where speed transformer units are operated under continuous conditions.

This speed transformer consists of a nest of plain spur gears revolving in oil, changing the revolutions per minute of the input shaft to some desired revolutions per minute of the output shaft. The power transmitted is the same at both shafts. The gears all have 20 deg. involute form-cut teeth and the short length of these teeth combined with their cross-section insures necessary strength.

The central housing is located in the main frame, and both high-and low-speed shafts are supported in double-bronze bearings. Oiling is accomplished through a splash sys-



Hill Spur-Gear Speed Transformer, Industrial Type

tem of lubrication obtained by a metal disk on the high-speed shaft that automatically lubricates the gears and bearings. The entire unit is inclosed and is dust proof and leak proof. Both high- and low-speed shafts are identical in axial alignment and revolve in the same direction. These speed transformers are made in seven sizes.

Lenox Reversible Socket Wrench

The American Saw & Manufacturing Co., 71 Boylston St., Springfield, Mass., has brought out a socket wrench in which toothed ratchets, pawls and springs are eliminated and the number of essential parts reduced to three; the lever, the head and the collet. A square, hexagon or other shape hole to fit screw-heads or the shanks of standard sockets can be used. The manufacturer of the wrench does not supply sockets, but will make the size and shape of the hole in the collet to take sockets that are already on the market.

The collet is a disk or hardened steel having a narrow groove to take the end of a small dowel-screw, that is tapped into the head, thus preventing the collet from coming out. The lever is pivoted in the head by a pin, held by a drive fit. The inner end of the lever is ground to a radius that is somewhat greater than the dis-

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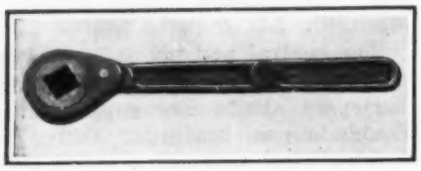
tance from the center of the pin-hole to the curved surface, so that while the collet is free to be turned by the fingers, a slight movement of the lever causes the curved end to jam against the collet and the combined parts thus become a friction ratchet.

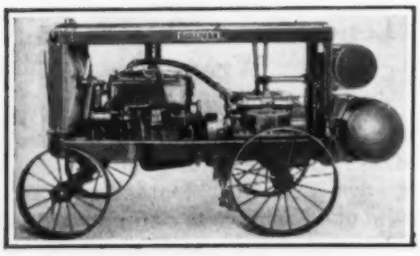


Lenox Reversible Friction Ratchet Wrench

The advantages claimed for this tool are simplicity, durability and the slight movement of the lever required to bring the friction ratchet principle in effect in confined places, and that it does not have to be turned to reverse the direction of rotation.

Sullivan Portable Air Compressor, Class "WK-314"

The Sullivan Machinery Company, Chicago, Ill., have developed a portable gasoline-engine driven air compressor, class WK-314, that is mounted on a four-wheel all-steel truck. The capacity of this machine



Sullivan Portable Air Compressor, Class "WK-314"

is considerably larger than the prevailing model.

Instead of the usual vertical arrangement for the air cylinder, this compressor utilizes a V-type, 4 cylinder compressor unit that produces 220 cu.ft. of air per minute. This 90 deg. arrangement of two pair of cylinders provides a counterbalancing effect so that excessive vibration is avoided, resulting in longer life of the equipment and a lower upkeep. At the rated speed of 800 r.p.m. against 100-lb. air pressure, the horsepower will be 43. The cylinders of the compressor are 5½ in. in diameter with a 5-in. stroke, single acting, and arranged in pairs slightly offset lengthwise from each other so that they operate from a single crank.

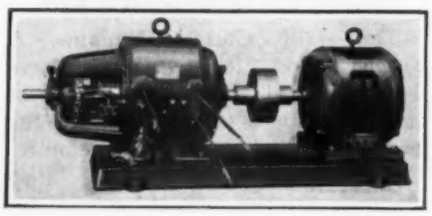
This machine is connected to a Buda, 4-cylinder, four cycle, 43 hp. gasoline engine, rated at 800 r.p.m. The motor and compressor are substantially fastened to a cast-steel frame. Machine surfaces insure accurate alignment of the main elements of the machine. Two heavy-duty angle posts, secured to the rear of the frame, support the air and gasoline tanks, the former built for a working pressure of 110-lb. and the last holding 25-gal. of fuel. A water radiator is located in the forward part of the machine, and a steel top of heavy gage is used to cover the equipment, this being easily removed to provide access for general repairs.

It is claimed that this portable compressor unit runs with as little vibration as is generally produced by a built-in compressor of the same rating.

"Alternarc" Welding Generator

The Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J., have brought out a welding generator that will give either alternating or direct current so that welding adapted to either current can be included in its application.

The same winding of the armature serves for both currents, so that no extra space is required. Two collector rings for the alternating-current supply are the only extra parts needed. The main feature of this equipment is that either d.c.



"Alternarc" Welding Generator

or a.c. leads may be short circuited at the collector ring or commutator without injury, as the voltage merely dies to a value that holds the current constant. When the short circuit is released, a normal voltage is resumed.

The generator is of ball-bearing construction and is provided with a take-off at both ends for driving purposes. The drive may be direct or by belt or chain and supplied by an electric motor, gas engine, steam engine or any source of power giving an equivalent of 7 hp. The illustration shows an electric motor-driven mount.

Haskins Portable Grinding Machine, Type CB-6

The R. G. Haskins Co., 516 West Monroe St., Chicago, Ill., have added a portable grinding machine, intended for general-purpose work, to their line of equipment.

The motor of this device is pro-

Haskins Portable Grinding Machine, Type CB-6

vided with a full swivel base permitting a flexible position when in operation, and the unit is mounted on a base having casters so that it can be transported as desired.

The speed of the motor is 1,750 r.p.m. and the driving shaft is ⅛ in. in diameter wound-wire, 6 ft. in length. A handpiece is attached to the end of the shaft to facilitate operation. The motor end frame is designed with a cast-in tool rest for holding the shaft when it is not being used.

The illustration shows a buffing wheel attached to this equipment and other tools, such as grinding wheels and sanding drums, can easily be substituted as desired.

News of the Week

Society of Industrial Engineers in Twelfth Conference at Cleveland

Discuss educational phases of the profession

The Society of Industrial Engineers held its Twelfth Conference at the Hotel Winton, Cleveland, on May 6, 7 and 8. The convention was opened by Andrew Squires, president of the Chamber of Commerce of Cleveland.

Col. W. G. Sheehan, president of the society then gave his report for the past year. During this time the financial standing has steadily improved and one important development that can be directly attributed to the work of the society is the appointment of a committee by the British Government to study the elimination of fatigue in industry.

Harry A. Hopf, of New York City, in his talk dealt with solving the problem of management through executive supervision. Management today, he stated, is performing or applying all units of control in an orderly fashion, in their proper place, and at their proper speeds. He spoke of the proper motivation and utilization of human factors. Management, in fact, can be said to be super-vision, as the manager has to keep his eye focused on the future and pierce through the present to what is going to happen and how best he can meet it. In dealing with the work of executives he stated that they are intended to make decisions and not postpone them, pointing out that the besetting vice of business today is committees. He added that standards of capacity and methods should be set up and performances should be measured against these objective standards.

Production Controlled by Orders

W. B. Ferguson, production manager of the Newport News Ship Building and Dry Dock Co., followed with a paper along similar lines to that of Mr. Hopf. He dealt more, however, with the problems of manufacturing to non-repeat specifications, and one point brought out was the fact that he had found the study of production results of great benefit. He paid special tribute to the paper by Ralph Flanders of the Jones & Lamson Co., stating that he derived benefits from those parts of the paper which he felt could be directly applied to non-repeat production. He made particular reference to the statement that there should be a plain job for every man and full responsibility with it, and secondly that production is controlled by orders rather than by records. One other important point brought out by Mr. Ferguson is that in non-repeat work emphasis must be laid in getting the work out from the drafting room, plans must be laid carefully and the initial work pushed well forward before proceeding with the orders.

The opening session on Thursday was devoted to a memorial meeting in honor of Frank B. Gilbreth. Col. W. G. Sheehan, president of the society, discussed Mr. Gilbreth's life from the standpoint of the work he had done in connection with the study of fatigue, pointing out that as yet we were on the fringe of development and that the surface had hardly been scratched. A. B. Segur, consulting engineer, of Chicago, spoke on the contributions made by Mr. Gilbreth to motion study of operations in the shops and particularly to the study made in the rehabilitation of those crippled industrially or by reason of war. John Younger, associate editor of the *American Machinist*, drew attention to the personal side of Mr. Gilbreth and illustrated his great fund of humor and his love of children.

Industrial Curriculum

The afternoon meeting took up entirely the question of what courses should be included in an industrial curriculum. Professor Hugo Diemer, director of industrial courses, La Salle Extension University, sounded the keynote in summarizing the results of the study as to what the industrial engineer does and what he is expected to do. The industrial engineer, he stated, carried on the following activities: He makes time studies, prepares instructions and sets standards of production as to time and method. He arranges machines in the departments so as to facilitate the best flow of production. He selects and installs labor saving devices and methods for eliminating fatigue and waste of material. He devises methods for planning, routing, scheduling, dispatching and inspecting production. He makes shop analyses, establishes classification of workers and wage incentive methods, and in general co-operates with the personnel department on devising training courses to fit them for more effective work. Naturally, these seem multifarious in their functions but in the small shop these functions may be carried out by one man just as well as in the large shop with its many men.

Professor Diemer outlined other functions of the industrial engineer dealing with the financial co-operation expected and stated that in the educational program we are at present in the transitional stage in which we are recognizing the importance of broadening the viewpoint of all engineering students. He then proceeded to the discussion of a merger of engineering fundamentals with business establishments. His curriculum showed the necessity for co-ordination between the two groups of study and he pointed out there is a tendency on the part of the schools of engineering to be satisfied to have the College of Commerce and Finance undertake to teach certain industrial engineering subjects. The natural result of this will be that graduates of a College of Commerce and Finance will be entitled to the use of the name industrial engineer and will actively enter the field of industrial engineering upon graduation.

Following this talk there was presented an ideal industrial engineering curriculum by Professor George H. Shepard of Purdue University and a discussion followed.

Mrs. Gilbreth pleaded for better co-ordination between the primary and secondary schools and the engineering colleges and President Howe, of Case School of Applied Science, believed there was no necessity for a course in industrial engineering and that standard fundamental engineering courses as taught conventionally are quite satisfactory. Dr. Hammerschlag, formerly president of the Carnegie Institute of Technology, drew attention to the difference in the refinements of accuracy in management as compared with those of science, pointing out that seemingly science dealt in great accuracy, and that management actually dealt just as closely. He emphasized the need for a renaissance in industrial education—our methods are too much those of the past and we have not enough vision in our engineering colleges. There is too much nullification of the creative mind by routine courses based on past and dead experience.

During the evening there were further talks, the principal speakers being Dr. Hammerschlag and Frank A. Scott, president of the Warner & Swasey Co.

Swedish Ball Bearing Factories Busy

The gross sales of the Swedish ball and roller bearing factories have increased steadily from month to month and the total sales for the year 1924 amounted to 28,200,000 crowns as compared with 21,940,000 crowns during 1923, commercial attache T. O. Klath, Copenhagen, reports to the Department of Commerce.

Despite reduced prices, the sales turnover increased considerably. Large orders for ball bearings and roller bearings received from foreign railways contributed largely to this increased trade.

Many World-Wide Problems Scheduled for Brussels Meeting

International Chamber of Commerce sessions promise interest

The International Chamber of Commerce will hold its third Congress in Brussels, Belgium, on June 21-27, inclusive. Some of the most disturbing economic questions before the world today will be discussed by representative business men from many countries.

Economic restoration will be the keynote of the meeting, in itself an extremely serious subject and one that affects the welfare and prosperity of every country in the world. It has to do principally with the problems arising out of the adoption of the Dawes Plan and the alarm that manufacturers in many countries have expressed over the fear of an inundation of manufactured goods from Germany in the discharge of her reparations obligations. The troublesome question of the payment of the international war debt is an allied subject, since it involves the transfer of goods from one country to another. Fred I. Kent, vice-president of the Bankers Trust Co., is marshalling much vital information on this topic and will play a leading part in the discussion.

Finance, Industry and Trade

The remaining subjects of the Congress are of a more technical nature. They are divided into three classes; finance, industry and trade, and transportation. Richard F. Grant, president of the Chamber of Commerce of the United States, will preside over the deliberations of the finance session. This meeting will take up the problem of double taxation, or taxation of the same enterprise by two or more countries—something that steamship companies, mining companies, and other corporations frequently have to face. Another topic for this session is that of the unification of laws governing the cheque in an effort to increase its use in international business.

On June 23 various problems having to do with industry and trade will receive attention. Unfair competition, particularly as it is expressed through piracy of trade marks, fraudulent use of patents, and similar trade abuses, will be a leading subject at this meeting. The reforms to be effected so that foreign judgments may be enforced under more favorable conditions than exist at present, furnish another topic for discussion. The Congress will also be invited to express itself regarding the definition of the term "commercial character" as applied to postal packages.

The third class, that of transportation, will occupy a large part of the program. Roy D. Chapin, chairman of the board of the Hudson Motor Car Co., will preside over a meeting to discuss motor transportation and highway development. Competition between the motor car and the railroad, and the relation between the two, will be one aspect of the problem.

Commercial aviation is essentially an international problem since the aeroplane in its use often passes over several frontiers. The standing committee on commercial aviation will study the progressive development of commercial aviation at the meeting.

Another resolution concerns reciprocal tax exemption for steamship companies as a practical method of combating double taxation. Regulations having to do with bills of lading, shipowners' liability and immunity of public ships, with the object of establishing some uniformity in the practices will be treated.

The Railway Transport Committee will submit to the Congress two resolutions, one concerning combined services between railway lines and between railway and ocean transportation, while the other resolution will be drawn against the obligation to give names and addresses of consignees on packages and railway trucks, a practice calculated to endanger the privileges of commercial secrecy.

The International Chamber of Commerce was created in June, 1920, and embraces representative organizations of industry, trade and banking in the principal countries of the world. It is a clearing house for information about international trade and trade practices. In its roster are found 329 Chambers of Commerce and 50 trade associations. The work of the international organization was instrumental in the formulation of the Dawes Plan, which was the result of one of its economic conferences.

Utility Men Plan National Research to Develop Industrial Gas Equipment

The establishment of a national research organization to make gas available to all industrial fuel users was the proposal made this week at the annual spring conference of the American Gas Association by Charles A. Munroe, chairman of the board of the Laclede Gas Light Co., of St. Louis.

As outlined by Mr. Munroe, the objects of the new organization, to be underwritten by the gas companies of the country, would be to develop efficient gas burning equipment for all fuel users in industry and enable the gas companies to meet the demand for gas fuel wherever heat is required.

"The present tendency to conserve our national resources, especially oil and natural gas, makes it inevitable that the manufactured gas industry will have to shoulder the heating burdens of the country," he said. "The gas industry is now equipped to supply all the immediate fuel requirements for industry, millions of dollars having been spent for improvements and new construction during the past two years.

"We must now go a step farther by developing gas burning appliances to make gas the universal fuel, as it is now the most economical medium, for even the most intricate and exact of heating operations.

"Although only 25 per cent of the present output of manufactured gas in this country is being used in industry, the majority of industrial fuel users are still either employing wasteful and outworn methods of combustion, or have been forced to turn to electricity, in spite of the fact that electricity costs three times as much as gas and that electric appliances cost twice as much as gas appliances."

Mr. Munroe proposed that a fund be provided to finance an organization to carry on research along these lines over a period of five years.

Foreign Commerce Increasing with Exports in Lead

In the report just issued by Chauncey D. Snow, manager of the Foreign Commerce Department of the Chamber of Commerce of the United States, it is stated that there was a continued increase in exports, and a decrease in imports during the year 1924. The monthly average for exports figured nearly $383,000,000, and the monthly average for imports nearly $301,000,000. Automobiles continued their upward course and would have ranked second in the value list, though still at some distance from cotton, if wheat had not again emerged from the ranks and claimed second position. Coal had to give way to the gasoline and naphtha group. America's labor-saving devices and modern equipment are going more and more to foreign countries. Our adding and calculating machines made a striking gain and our typewriters were bought in increasing numbers. Agricultural machinery exports established a new high record. Radio apparatus, now given a class by itself, exceeded last year's combined figure for telephone and telegraph and radio equipment.

On the import side raw silk lost its preeminence at the head of the list to its persistent competitor — cane sugar. Crude rubber imports, though less than a year ago in value, were credited with increased tonnage. The increases in silk and rubber and such tropical and sub-tropical commodities as coffee, cocoa and coconut oil are among the outstanding features of present day trade compared to the imports before the war.

The official statistics now show for the first time our parcels-post exports. In 1924 we exported by parcels post $21,420,000 worth of merchandise, and imported by parcels post $107,189,000 worth.

The data are based on the official statistics published by the Bureau of Foreign and Domestic Commerce.

The fiscal year 1925, which ends in about five weeks, according to the National City Bank of New York, will show the foreign commerce of the United States over 8½ billion dollars against 7¾ billions in 1924 and less than 6½ billions in 1922, all of these figures relating to fiscal years. This increase of more than two billion dollars since 1922 is about equally divided between imports and exports. Imports of the fiscal year 1925 will exceed those of 1922 by about one billion dollars and the exports will exceed those of 1922 by about $1,200,000,000.

Actual Conditions in Great Britain

Industrialists complain that optimistic reports are false—Shipbuilding in a bad way—Motor car builders and railroads the only machine tool buyers—The Wembley Exhibition

By Our London Correspondent

DISILLUSION, even exasperation, has shown itself recently in the public statements of some of the leaders of industry in this country, and expression is being given to the concern felt regarding the state of trade, with special reference to engineering and the heavy steel, shipbuilding, coal, woolen and cotton trades. The optimistic opinions expressed in the past from time to time have been criticized as misleading, and it is at last being openly recognized that, in present world conditions, it is useless to attempt merely to talk-up or write-up such industries.

Many workpeople and others have been misled as to actual conditions. They have taken would-be encouraging statements at their face value and workers have demanded better employment conditions on the ground that trade generally could well afford it. In some branches wages have been rising for a little time. Up to a point they can be forced up and easier employment terms given, at least in the trades known as "sheltered." The sheltered industries are being recognized as having a handicapping effect on the trades that have to meet world competition.

Though other forces seem to be collecting on each side, better co-operation between employers and employed is being urged, and it is at least a good sign of the times that conferences are being held by several of the leading industries.

Shipbuilding has been much in the limelight of late and, with about one-third of its workers unemployed, it is probably in the worst condition. A number of causes have been suggested, including the decline in naval building, the depression in the shipping trade, and extended competition overseas.

Industrial Relations Better

Within a comparatively few years the general relationship between employers and employed has changed markedly. Workpeople are no longer contented to be regarded as "hands," to be taken on or off as the employer may determine, but are insisting on a steadily increasing share in the conduct of industry. Councils and committees of various kinds meet for the purpose of removing causes of internal friction and they sometimes do it. The difficulty has been to get a recognition of the interactions between the whole of the industries, so that—to take an obvious case—a high price for coal may be seen to imply a high cost for steel produced and therefore for the same reason for ships.

Taxation, both imperial and local, has been greatly increased, and the burden in some instances approaches the intolerable. In some instances workpeople are sufficiently powerful to retard the introduction of new or improved machines, and not all the promises of increased output in return for improved conditions of employment have materialized.

Production Costs High

The present position has led to a considerable number of public inquiries, largely official. Giving evidence before one of these committees recently, D. A. Bremner, director of the British Engineers' Association, mentioned that, reckoning back to 1913 values, exports of all metal products from Great Britain amounted last year to rather less than 80 per cent of the corresponding exports in 1913. Against this imports were about 102 per cent. For this position the dearness of British products in the world markets was held to be the cause, the cost both of production and distribution being h[illegible]. As reasons for these high costs it is alleged again that we are attempting to live on too high an economic plane as compared with the new values produced, that hours of working are too few, that remuneration rates are too high, with inequitable distribution of wages caused by trade union actions, and that national and local taxation is too heavy a burden. Immediately observable causes noted included the lack of demand at current prices, foreign competition, high cost of raw material, and high rates of wages per unit produced, of standing charges, transportation and taxation. Regarding the last, some relief is hoped for. The budget has resulted in a net surplus, small but sufficient, and nearer to estimate than for some years past.

Cost-of-living figures tend to decline, although this may be but a seasonal effect. The outstanding fact is that we appear to have a regular army of unemployed which, as known on the official registers and therefore in receipt of the so-called dole, always exceeds one million in number, the figures being between 1¼ million and 1¼ million.

In these circumstances any marked improvement in the machine tool industry, which, after all, is but a section of the engineering industry, cannot be looked for immediately. Recent reports from the different machine tool centers vary, and a few more firms are liquidating or closing. But for the motor trade and to a lesser extent the railway orders, the position would be even worse. The automobile and allied industries pursue their successful career. Electrical engineers show some anxiety regarding the future. Still on the whole they may be regarded as well employed. Though their shops are certainly much better equipped than was the case before the war, there is, to judge by suggestions, some room for improvement yet.

The demand generally is so poor and the competition of second-hand tools is so great that some distributors are not troubling about agencies, but, on the other hand, are simply buying "bargains," either at public auctions or privately, and are selling them as and when they can. One well known firm of merchants, stated recently to the writer that they could not regard more than 30 or so of the engineering firms on their lists as at the moment really potential purchasers.

Not long ago there seemed to be almost a scramble for German agencies. This has stopped, though several German machine tool firms are now directly represented in Great Britain.

Ford Exhibit at Wembley

A second edition of the Wembley Exhibition, to run from May to October, will, from the engineering point of view, be shorn of a number of its last year's glories. Instead a housing display will be prominent, to cover more than 60,000 sq.ft. To mark the centenary of passenger locomotion by steam, transport exhibits will, it is hoped, be collected, and arrangements have been made with the Ford Motor Co. of England to show the work of assembly by means of a moving conveyor 100 ft. long, this exhibit occupying 11,000 sq.ft. The cars completed at Wembley will be on sale in the London area.

March Exports of Machinery

Exports of metal-working machinery during March, with revised comparative figures for March, 1924, as compiled by the Department of Commerce, are as follows:

	Mar. 1924	Mar. 1925
Lathes	$70,937	$261,593
Boring and drilling machines	43,922	60,582
Planers, shapers and slotters	22,725	76,773
Bending and power presses	25,669	74,412
Gear cutters	65,653	84,196
Milling machines	29,930	227,121
Thread cutting and screw machines	41,566	89,007
Punching and shearing machines	4,940	20,420
Power hammers	14,434	23,963
External grinding machines	80,862	202,243
Internal grinding machines	21,733	46,913
Other grinding and sharpening machinery	25,507	63,341
Chucks for machine tools	21,821	36,509
Reamers, cutters, drills, taps, and other metal-working tools	149,127	278,362
Pneumatic portable tools	60,766	97,859
Foundry and moulding equipment	36,997	49,951
Other metal-working machinery and parts of	338,489	520,628
Total	$1,057,078	$2,213,873

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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GENERAL Grant once remarked that he knew a man who had succeeded famously by following an unusual method. When asked to describe the method he answered, "He attended to his own business."

The story fits the situation in the United States today. Speculation there always will be, and the speculation of the intelligent professional serves a good purpose, just as do the insurance companies and the underwriters.

But of ignorant and thoughtless speculation by those who neglect their regular work there is less than for years, and most people seem to be settling down to the industrious pursuit of success along the lines in which they have acquired proficiency by training.

One result is an enormous increase in the life insurance written, another is an astonishing growth in savings bank deposits and a third is relative quietude on the exchanges where speculation is conducted.

All this is healthy, but it is not exhilarating, and some who confuse extravagance with prosperity are depressed because the American people are becoming thrifty. This depression is of course unwarranted, and its absurdity is already being made apparent in many directions.

There is, for example, the surprising activity in building reported from the Middle-West. The increase in eight states is put at 26 per cent for the first four months of this year. As a consequence there is less unemployment and a much better demand for lumber and other material. But the improvement is not as yet affirmatively reflected in the demand for steel or copper and those who claim to know say that the reason is that the railways have supplied their major requirements and are no longer buying in quantity.

Hesitancy is also noticeable in some other quarters where bullish enthusiasm recently prevailed. The market for wool is almost paralyzed and holders are trying to put off the evil day of liquidation by refusing to sell. Coffee is in much the same position. The decline already established has caused the failure of one very important firm at Frankfurt in Germany, and buyers are holding off in the fear that the unsold Brazilian stocks are much larger than has been admitted.

Distant coffee deliveries are now approaching twelve cents. At ten cents, if it is touched, purchases to replenish exhausted stocks may be advisable, but anticipatory buying would be unwise until a fuller knowledge of the Brazilian situation is to be had.

Cotton has also declined upon a suppositious improvement in the crop, but at 22 cents it has probably reached the mean of intrinsic value for the present. Sugar at about 2⅝ cents for Cuban raws is in much the same position. That it is below the cost of production is becoming generally understood and the surplus is passing into the hands of speculative investors who are content to carry it. Tea and rice are two other grocery staples that seem to be about as low as they are likely to go for the present.

What's Doing in Industry

Business conditions throughout the country have brightened up considerably in the past ten days. The stock market is quiet but firm; money is easier, and crop estimates are unchanged.

In the machine tool industry the Middle-West holds the center of attention. Detroit reports employment almost up to pre-war normal and orders for heavy production machines, industrial equipment and small tools have increased substantially in the past week. In some localities in this territory sales in the first three weeks of May have far exceeded those of the entire month of April, and present inquiries indicate a continuation of this volume.

In New England the smaller industries are expanding and are buying sparingly of new equipment as necessity demands. While orders have been on a hand-to-mouth basis, they are nevertheless from ten to twenty per cent in excess of April.

The Eastern market, centered around New York, shows improvement even though the business is scattered over a large territory. The foreign market has loosened up and a good business is being done in special machines and small tools. Industrial accounts are the most fertile in this market at this time.

The picture painted in our review this week is brighter than it has been of late. The latest statistics of the machine tool industry show that for the month ending April 30 new orders were on a par with those of February and only slightly behind those of March. Better business might not be as fundamentally sound.

In the dry goods market there is an eager demand for silks and rayon fabrics, although raw silk is a shade lower. Cotton goods, especially denims, are also lower, but a better business is reported at the decline and the large consumption of raw cotton during April seems to indicate that the mills feel reasonably confident of the future.

In Chicago the liquidation of May wheat is being accomplished on a rising market, which is unusual, but there is little public interest left in grain and the future is entirely a question of the crop outlook. Just now it seems unpropitious, but it may change. The Government estimates the carryover July 1 at 125,000,000 bushels, as against 283,000,000 in 1924 and 256,000,000 in 1923. This is enough, but not too much, and supply and demand will be nicely balanced until the new crop is harvested.

The stock market is relatively but not abnormally quiet. The railroad stocks have been firm and it is a poor road that isn't being bought up by some consolidator nowadays. But it will be well to remember that the Interstate Commerce Commission must approve the consolidations proposed before they can be consummated and that "there's many a slip twixt cup and the lip." Meantime there is a possibility that Congress may become a rate making body, for there is a lot of complaining about high railway rates to be heard on all sides.

There are latent possibilities of trouble in the railroad situation that should not be disregarded by overconfidence in higher prices for railroad stocks. The money market continues easy. The reserve ratio of the Federal Reserve System is up to 77.2 per cent, as against 76.3 per cent a week ago and 83 per cent last year.

The news from Europe is in the main satisfactory. Caillaux is promising to make the French farmers pay taxes and talking about funding the French debt to the United States. But thus far he has not been able to do more than talk. Meantime our foreign trade continues to grow and our exports and imports in April taken together were worth $749,000,000, of which $400,000,000 were exports. For the ten months ending with April the excess of exports over imports was about $500,000,000.

This is near the prewar average and is another indication that we are getting back to normal and settling down to work.

That such is the case is reassuring and the best guarantee of real prosperity that we can have.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

To dealers in machine tools and special machinery the outlook for an improved market seems to be brightening. Inquiries, which for a time showed a material slump, are being received in fairly satisfactory number. Such orders as are being booked are for small lots, no sales of major importance having been reported during the week. The Rock Island Railroad has added a number of wood-working tools to its list of requirements, but, with this exception, railroad inquiries have been negligible.

Reports are current to the effect that the C. B. & Q. Railroad will shortly announce its awards on the bids it has received for machine tools, and the dealers interested are expectantly awaiting this announcement, as well as that of the Illinois Central for its Markham Yards equipment. Considerable encouragement to machinery interests is found in the orders just recently placed by the C. M. & St. P. R.R. for 5,500 miscellaneous freight cars, involving an outlay of approximately $12,000,000. The basis for optimism on the part of dealers is by reason of the fact that, of the seven manufacturers who have been awarded contracts, the majority are in the Chicago district, not far distant from the city.

Detroit

As a result of the new all-time automobile production record made in April, when 420,373 cars and trucks were manufactured in the United States representatives of machinery and machine tool companies in Detroit and southeastern Michigan are satisfied that sales will remain at practically the same level as they have been for the past two months.

Electrical equipment seems to be more in demand than for some time past, with many of Michigan's plants augmenting present power facilities or installing their own power plants. The market for used tools remains practically stationary with a demand for smaller lathes and drilling machines rather than for any special equipment.

The Royal Oak Tool and Machine Co. has been organized in Royal Oak, Mich., one of Detroit's suburbs, with Garrett N. Mouv as president. The company plans to erect a factory building and is in the market for machinery to equip the plant.

The Lindell Drop Forge Co., of Lansing, has been purchasing considerable equipment, consisting of broaching machines and milling and drill presses. Among other additional equipment being installed are four hammers.

The Hillsdale Manufacturing Co., of Hudson, Mich., will install additional machinery in its plant which is now being enlarged.

Construction has already begun in Benton Harbor, Mich., for the General Die Castings and Machinery Co. It is understood that quite an extended list for machinery and tools has been sent out.

April was the greatest production month in 31 years of automobile business exceeding by 15,000 vehicles the best previous month on record, May, 1923. Steady production of all the automobile leaders has given to the machine tool and machinery industry a feeling of security for the next few months. This feeling has been growing steadily as the employment figures in the 79 automobile and accessory plants of Detroit climb up. The latest report shows Detroit employment to be about 3,000 under the high figure for all time. Indications are that last year's peak will be exceeded within a few weeks.

Cleveland

Manufacturers of automatic machinery in the Cleveland district report that more business was placed in the first four months of 1925 than in the preceding eight months of 1924. Continued improvements were noted during the first part of May and manufacturers are of the opinion that the peak will be reached in mid-summer. Additional salesmen have been employed to follow up the large number of inquiries coming to the local industry.

The planer market continues active. Orders received by the local industry included large planers from the Pittsburgh Plate Glass Co., and a Western railroad.

The shear and punch division has shown some stimulus in the last ten days, but this activity has been confined largely to inquiries rather than actual sales.

The City of Cleveland is planning new building extensions for its machine shops in the light and water plants.

Milwaukee

The comparatively quiet state of trade in metal-working equipment which became noticeable during the early part of April and continued through until the beginning of May seems to be subject to at least perceptible relief, although the volume of business is not increasing substantially. Save in a few instances, users of machine tools are marking time and are adhering rigidly to a policy of buying equipment only when necessity requires, and then with a view of being able to keep the added machinery in operation beyond the time of the emergency which has brought about the purchase.

The automobile trade, while it is placing no volume orders, is undoubtedly the best group of buyers at present. Purchases are confined almost entirely to necessary replacements of obsolete or worn out machines, or the adoption of advanced designs by which it is possible to effect economies in man-power or gain materially increased output. It is this class of business that is enabling the manufacturers of metal-working machinery to maintain their business at a reasonable state of activity, for the trade as a whole is not finding it necessary to enlarge shops and equipment, having in most cases more capacity than the present business volume requires.

This is true of the agricultural machinery industry, for despite the distinctly upward trend of its business, it is still far from being confronted by any need of adding buildings or machinery. Of all the major industries, the farm machinery business probably had greater need for replacements of equipment than any other because of the lengthy period it passed through when a very small percentage of its capacity was utilized, and there was no inducement or need to keep step with other industries in providing the most advanced tool designs.

So far as railroad business is concerned, but little of the new machinery actually needed in repair shops has been purchased and there is no immediate prospect of business being placed.

The electrical industry is busy and industrial requirements have declined slightly, but a better inquiry is again reported.

Cincinnati

The great majority of machine tool manufacturers in Cincinnati report that the demand for all classes of tools is decidedly better this week than it was last. Domestic orders placed and inquiries received have emanated from widely-scattered sections of the country, and from this it is evident that business improvement is general, not merely of a local nature. There are also indications that the foreign market is improving, there being a slight increase in sales and a considerable increase in the number of inquiries received.

In some cases it was reported by machine tool manufacturers that their sales for the first three weeks of May were greater than the total sales for

April. While all have not had this experience, there has been reported by nearly all a general increase of sales since the first of the month. The experience of the machine tool dealers is about the same as that of the manufacturers, and all report that trade conditions are improving.

One machine tool manufacturer, who has just interviewed a large group of men in the same business, reports that their sales and inquiries are increasing in number, and all are confident of continued improvement. The outstanding feature of the market seems to be that it has a better general tone, with decreased sales-resistance and a diminished tendency to ultra-conservatism, which has been the one drawback in the past weeks.

New England

Some substantial buying during the past week was reported by machinery salesmen in New England, working out from Hartford and Springfield. This class of business was principally by smaller machine plants and was characterized as buying for expansion. The equipment was mostly of the small tool variety. Hand tools were also well bought.

Special machinery builders report an active business at the present time. Requirements of the textile trade assume large proportions and builders of looms are not only increasing their forces but are also expanding operating schedules. These orders are said to be representative of the best business appearing in this industry in eighteen months.

Demand for presses and lathes shows an improvement and the sentiment of manufacturers is more optimistic. The concensus of factory heads in different centers agreed that the buying is of a conservative order—in fact by one factory representative it was described as "inadequate for actual needs." The requirements represented by inquiries is ahead of the volume represented at the same time a year ago. Time has now been taken to digest the business of the first three months and general improvement is admitted everywhere. Betterment in the gross business ranged from 10 to 20 per cent and net earnings were higher than a year ago. The trade condition is acknowledged to be satisfactory and in some cases better than expectations, but because boom conditions have not been forgotten there is a disposition to tinge comments with a flavor of pessimism.

Buffalo

Conditions in the machine tool business here may still be termed spotty, and at the present time vary little from that of the month of April.

It is encouraging, however, that dealers are reporting for the first ten days of May a more encouraging attitude on the part of manufacturers than has been the case in many weeks, and in some cases since the first of the year. There are several instances reported in which manufacturers, instead of marking time or actually curtailing operations, are actually putting on more men or are planning to do so within the next few weeks.

One or two of the dealers who had noted this condition were more encouraged by the signs of renewed activity than they had been in many weeks. This condition also marks an increase in the number of inquiries for various pieces of equipment to bring the normal shop equipment up to standard.

Reports are unavailable from some of the dealers, for many of them are on sales trips in the field outside of Buffalo, but practically all of the offices reported more inquiries, chiefly from industrials.

One dealer reported that April had proved to be a very good business month for him and that the Buffalo office was one of three in the United States which had reached in April the quota of business assigned. He was frank to say, however, that no particular importance should be attached to that because three or four good sized orders went on the books that month which had been hanging fire for some time.

The railroad field is quiet and little activity is reported in the electrical field. Whether or not the important consolidation of western New York power interests will have any immediate effect on construction and the use of electrical equipment it is yet too early to say with authority.

There are signs of increasing activity in the small tool business and two dealers who handle considerable of this business are optimistic and think the May business will make a good showing.

New York

The New York market continues to show a slight improvement over previous weeks, though the change is more or less general, nothing having developed to warrant a specific statement about any one particular phase of the business.

There is an unmistakably better tone in the machine tool market, and while orders are split up among many types of tools, and inquiries are spread over a wide range of territory, there has been a decided awakening on the part of buyers. Investigation shows that industrial plants are the best customers of the machine tool trade right now. Special machines for quantity production, and particularly ones that cut down time and expense, are being sought by the electrical and automotive fields. Small grinders and punch presses are in demand and always the machine with the greatest capacity is the best seller. The automotive industry, right now at the peak of its seasonal production, is active in buying new equipment and reports are current of fairly good orders received by dealers from this source. Growing competition in this industry has made it necessary for manufacturers to apply the most economical and efficient methods and this has broadened the market for machine tools of a special character that are designed especially for accurate and speedy production.

The seasonal lull that was expected in industry has not materialized, as is evident from the reports of business activity in manufacturing lines. It is rumored that the boom that seemed certain during the first month of this year was purposely headed off by financial powers, because it was judged better to spread a fair volume of business over twelve months rather than crowd this volume into a brief three or four-month boom. There are many factors in the machine industry who believe that this is the reason for the spotty condition of the market today, but they are satisfied that a good volume of business will be had throughout the entire year, which they argue is a better choice than a brief spell of prosperity followed by depression. The foreign market has shown signs of awakening during the past two weeks. One manufacturer reports several sales of precision measuring machines to important industries in Central Europe, where industry has taken on new life in the past few months. Several inquiries are also reported for special production machines from this same source and shipments to England and Germany have gained slightly.

One dealer who confines his business to general industrial plants was frank in stating that his business this year was twenty-five per cent better than last year and indications for holding this ratio were very good.

Canada

The demand for machinery and machine tools in Canada is growing more active each week, this being due to a continued improvement in industrial conditions generally. Many companies report bookings in excess of those during March and the general impression is that the spring season, on the whole, will equal the totals of the corresponding period in 1924.

The steel mills continue an active program. The Algoma Steel Corporation's mill is back on double shift following the relief of congestion in its yards by the opening of navigation. It is reported that the British Empire Steel Corporation's mill at Sydney will soon start the rolling of 1,380 tons of rails for the Quebec Central Railroad. The Pacific Bolt Manufacturing Co. has a considerable order for supplies for Western railroads, which will be taken care of at the company's new plant on Granville Island, British Columbia. The Canadian General Electric Co. has been awarded a contract for the electrical equipment for the new mill of the International Paper Co. at Three Rivers, Quebec, an order amounting to about $800,000.

During the month of April General Motors of Canada, Ltd., produced and shipped the largest month's production in its history. Most of this production was delivered to the domestic market. The Dominion Engineering Co. has received an order from the International Paper Co. for four newsprint machines for the new mill at Wayagamack, Quebec. A large quantity of machinery has just arrived from Manchester, England, to be used in connection with a 200-ton newsprint mill and in a 150-ton ground wood mill which are being constructed by the Wayagamack Pulp and Paper Co.

Steel Treaters Convene Next Week

Practically all of the details of arrangements for the program for the Spring Sectional Meeting of the American Society for Steel Treating to be held in Schenectady, May 28, 29 and 30, have been made, and indications are that this meeting will be one of the most successful and widely attended of all the sectional meetings which have been held by the society. The Meetings and Papers Committee has arranged a very comprehensive program and the Plant Visitation Committee has made arrangements for some very interesting plant visits.

The new Hotel Van Curler will be headquarters for this meeting. Among the papers to be presented at the technical sessions are:

"Some New Developments in Stainless Steel," P. A. E. Armstrong, vice-president, Ludlum Steel Co.

"The Relation of Crystal Orientation to Magnetic Properties of Silicon Steel," W. E. Ruder, metallurgist, research laboratories, General Electric Co.

"Case Carburizing," B. F. Shepherd, metallurgist, Ingersoll-Rand Co.

"Results of Examination of Metals with X-Rays," Colonel T. C. Dickson, commanding officer, Watertown Arsenal.

W. S. Biddle, president of the society will preside at the meetings.

Navy Perfects Small Engine for Aircraft

A new design small air-cooled engine for use in small air-planes for shipboard use has been developed by the Navy and has lately passed its block tests. This engine develops 80 hp. at 1,800 r.p.m. and weighs only 208 lb., or 2.6 lb. per hp. This engine has been built and tested under Navy Department specifications by the Kinney Manufacturing Co., Boston, Mass.

The engine is a static-radial having five cylinders. The usual push rod construction for actuating the valves has been eliminated and in its place has been substituted a hydraulic valve gear utilizing the lubricating oil.

The first engine recently passed all tests and is being shipped to the naval aircraft factory for further test running. Four additional engines will be completed at an early date and will be installed in small aircraft for further flight development.

Railroads to Place Orders for Rolling Stock

The New York Central Railroad Co., the Michigan Central Railroad Co., and the Cleveland, Cincinnati, Chicago & St. Louis Railway Co., have applied to the Interstate Commerce Commission for authority to issue equipment trust certificates to apply on the purchase of the following equipment: For the New York Central — one thousand 55-ton steel box cars, twenty-nine steel motor passenger cars, ten 73-"6" steel dining cars, ten 70' steel passenger coaches, fifteen steel baggage cars, two hundred 35-ton refriggerator cars; for the Michigan Central Railroad Company — one thousand 55-ton steel box cars, two steel dining cars, five steel baggage cars; for the Cleveland, Cincinnati, Chicago & St. Louis Company—one thousand 55-ton steel box cars, 1,500 high-side gondola cars, ten steel dining cars, 25 steel baggage cars.

The Baltimore & Ohio Railroad Co. has applied to the Interstate Commerce Commission for authority to issue equipment trust certificates to apply on the purchase of the following equipment: 2,000 steel box cars, 2,500 steel gondola cars, 500 steel gondola cars, one dining car, four dining cars, twenty passenger coaches.

National Pressed Metal Society Formed

The first meeting of the recently formed National Pressed Metal Society was held in Chicago on April 11. The society is strictly a technical or engineering society and its activities will be devoted exclusively to discussions of the arts and sciences connected with the pressing of metals.

Endorsement of the undertaking has been given by a large number of men in the field and applications for membership have been received from a number of industrial executives.

At this meeting F. J. Rode, mechanical engineer, of the Marquette Tool and Manufacturing Co., Chicago, spoke on the "Selection of Pressed Metal Equipment." He cited several examples with reference to the equipment and operations used in different plants, but on the same stamping. The importance of selecting equipment of the proper capacity for each operation was emphasized. The use of equipment far in excess of the necessary capacity, with its slow operating speeds and high depreciation charge, often represents the difference between profit and loss.

The officers for the coming year are: President, John C. Biemeck, Coonley Manufacturing Co., Chicago; vice-president, George E. Wattman, Adams & Westlake Co., Chicago; secretary-treasurer, D. L. Mathias, The Anderson Co., Pittsburgh. The temporary office of the society is located at Pittsburgh, Pa., Box 65.

Engineering Foundation Honors Swasey

A dinner at the Union League Club, in honor of Ambrose Swasey, of Cleveland who established the Engineering Foundation ten years ago through a gift of $500,000, marked the close on the evening of May 14, of the quarterly meeting of the foundation. Charles F. Rand, retiring chairman, reported that new bequests were being made to swell the fund available for research work in engineering.

Other speakers at the dinner were J. V. W. Raynders, president of the American Institute of Mining and Metallurgical Engineers; Frank B. Jewett, who spoke on permalloy cables for the submarine telegraph, and Edward Dean Adams, vice-chairman of the foundation, who presided.

Business Items

The Threadwell Tool Co., of Greenfield, Mass., has purchased the plants, machinery and patents of The Wells Corporation and will continue the manufacture of taps, dies, screw plates and small tools. The directors of the new organization are: George Roberts, Francis L. Robbins, Jr., Lawrence M. Bainbridge, Charles A. Ruberl, Charles H. Keith, Otto Kolstad and W. S. Keith. Officers elected are: Charles H. Keith, chairman of the board; Otto Kolstad, president; W. S. Keith, treasurer. The manufacturing organization of the Wells company has been retained and Louis E. Peck is manager and Herbert J. Smith is superintendent.

The Fellows Gear Shaper Co., of Springfield, Vermont, announces that Louis G. Henes has been appointed representative in the California, Arizona and Nevada territories. Mr. Henes has headquarters at 218 E. Third St., San Francisco.

The Timken Roller Bearing Co. of Canton, Ohio, has purchased the assets of the Gilliam Manufacturing Co., also of Canton, for about $2,700,000. The Gilliam company manufactures tapered roller bearings. Dividend in liquidation of $200 a share will be made at once, and the balance as soon as incidental expenses and federal taxes can be determined. The production of both Timken and Gilliam bearings will continue in their respective plants.

The E. L. Essley Machinery Co., of Chicago, announces that it has completed arrangements with the Colburn Machine Tool Division of the Consolidated Machine Tool Corporation, whereby it will represent the Colburn line of vertical boring and turning mills and heavy-duty drilling machines in the Chicago territory.

The Timmers Machine Works, Inc., of 22 S. Clinton St., Chicago, manufacturers' agent for new and used machinery, has leased the one-story building now being erected at 225-7 N. Ashland Avenue.

The Union Tank Line, a subsidiary of the Standard Oil Co., of Indiana, will build a new plant at 129th St. and New York Ave., Whiting, Ind., the plans for which include a 150x500 ft. car building and repair shop, and a 60x240 ft. machine shop and foundry building.

Announcement has been made of the appointment of Keuffel & Esser, Montreal, and A. G. Cumming, Ltd., Toronto, as Canadian agents for the sale of the blueprinting machinery manufactured by the Paragon Machine Co., Rochester, N. Y.

The Cleveland Punch and Shear Works Co., Cleveland, has completed a plant extension program including the addition of considerable new equipment that will result in an increase of about 50 per cent in capacity. In addition the company has appointed Robert J. Pardee vice-president and works manager, and Arthur Schloz press engineer.

Both have been connected with the Toledo Machine and Tool Co., Toledo, Ohio, for about fifteen years, Mr. Pardee as assistant to the president and Mr. Schloz as head designer.

The Cleveland Punch and Shear Works Co. has added to its regular line the designnig and manufacture of power presses for the manufacture of stampings from sheet and bar stock. The company has sales offices in New York, Chicago, Philadelphia and Pittsburgh, and will shortly open a sales office in Detroit.

At the last regular meeting of the board of directors the following officers were elected: W. D. Sayle, president; W. C. Sayle, first vice-president and general manager; A. L. Bechtel, vice-president and chief engineer; R. J. Pardee, vice-president and works manager; H. C. Sayle, vice-president and metallurgist; A. C. Eckert, secretary and treasurer; H. J. Corrin, sales manager; W. J. Stewart, advertising manager.

The Smith-Springfield Body Corporation, West Springfield, Mass., has elected James M. Swift, of Boston, president to succeed C. S. Dame, and Frank M. Livingstone, of Springfield, succeeds Mr. Dame in the office of treasurer. Hinsdale Smith, of Springfield, former president of the company, has been chosen vice-president in charge of engineering, and Ralph M. Sparks, of Boston, is made vice-president in charge of sales. Directors, in addition to the foregoing, are E. L. Bennett, Boston; Nathan P. Avery, Holyoke; Charles L. Burrill, Boston; L. L. Homer, New York; George B. Caldwell, New York; Arthur P. Smith, Granby. The company is being reorganized with a view to a more active program of operations, said to look to the production of large motor bus bodies.

The Hess-Schenck Co., dealer in machine tools, 801 St. Clair Ave., N. E., Cleveland, has moved its office and warehouse into the building at 3868 Hamilton Ave., Cleveland.

The plant of the Standard Machine Co., in Owosso, Mich., recently destroyed by fire with a $50,000 loss, will be rebuilt immediately.

Real estate and equipment of the Wells Corporation, Greenfield, Mass., which went into the hands of a receiver in March, 1924, was sold on May 8 to a committee of the bondholders for $94,000. The properties include three tool manufacturing plants in Greenfield and one in Williamsburg. Plans to continue the operation of the reorganized company have not yet been completed.

The following Chicago concerns have been granted certificates of incorporation by the Illinois Secretary of State:

The Jones Gear Co., 29 East Madison St., capital $500,000, to manufacture and deal in vehicle steering gears, automobile appliances and other similar devices.

Hannauer Car Retarder Co., 139 W. Van Buren St., capital, $100,000, to manufacture and install car retarders, truck brakes, and devices of a similar nature.

William H. Keller, Inc., of Grand Haven, Mich., announces the removal of its New York offices from 30 Church St., to 54 Dey St. A. B. Inness is district manager.

At the annual meeting of the Maxwell Motor Corporation in Detroit, B. E. Hutchinson, vice-president and treasurer, and W. Ledyard Mitchell, vice-president in charge of manufacturing, were added to the board.

The Foote Bros. Gear and Machine Company, is now represented in Southern California and Arizona by the Fulton Engineering Co., 612 American Bank Building, Los Angeles.

The Lynn Die Co., 103 Sagamore St., Lynn, Mass., has awarded contract to William Dinneen of that city for the erection of a factory unit 30x60 ft. in City Hall Square, Lynn.

The Austin Company, of Cleveland, announces the removal of its New York office to the Equitable Bldg., 120 Broadway. This office is in charge of J. K. Gannett, assisted by A. D. Engle and D. C. Raymond.

Negotiations have been completed for the sale of the American Auto Trimming Co. plant of the Gotfredson Corporation, Detroit, to the Briggs Manufacturing Co. The consideration is said to be in the neighborhood of $1,500,000.

The American Auto Trimming Co., which, with the merger of Gotfredson interests during the past year, became the motor body division of the Gotfredson Corporation, is one of the largest independent auto paint and trim plants in the industry. The plant is on Meldrum Ave., from Mack Ave. to Benson Street.

Personals

DANIEL L. DAVIS has been appointed district sales representative in Milwaukee for Jos. T. Ryerson & Son, Inc., of Chicago.

STRICKLAND KNEASS, JR. has resigned from the Youngstown Sheet and Tube Co., and has become associated with the newly formed Costello Engineering Co., Leetsdale, Pa.

RONALD H. ALLEN, of Fulton, N. Y., has been appointed assistant trade commissioner to Warsaw, Poland. Mr. Allen has been associated with the industrial machinery division of the Department of Commerce under Director Julius Klein.

D. BLAIR BURLEIGH has been commissioned to go to Europe for the Rockford Tool Co., the Rockford Milling Machine Co., the Barnes Drill Co., and the Rockford Drilling Machine Co., all of Rockford, Ill. Mr. Burleigh will sail on June 15, and will remain abroad for three or four months.

W. L. THOMPSON, for the last five years field representative of the Jones & Lamson Machine Co., of Springfield, Vt., will leave May 27 for Europe to be special European representative for the company, with headquarters in Paris.

PETER VOSS, associated with the Timken Roller Bearing Co., of Canton, Ohio, has been elected president of the Purchasing Agents' Association of Canton and Eastern Ohio.

B. H. ACKLES, of the T. B. Rayle Co., Detroit, has been appointed a member of the planning committee in the division of simplified practice of the Department of Commerce. Mr. Ackles is president of the National Supply & Machinery Dealers' Association.

JAMES GILL has been appointed assistant sales manager of the Foster Bolt and Nut Manufacturing Co., of Cleveland, Ohio.

FRED E. MESTA has been elected president of the Mesta Machine Co., West Homestead, Pa. He succeeds his brother, the late George Mesta to the leadership of this well-known engineering organization.

E. A. COUSINS, formerly Detroit representative of the Westinghouse Electric and Manufacturing Co., is now connected with the Detroit office of the Hyatt Roller Bearing Co., as sales manager.

D. M. AVERILL, former vice-president and general manager of the Dort Motor Car Co., has become vice-president and general manager of the Ajax Motors Co., the new subsidiary of Nash Motors.

WILLIAM E. HOLLER has resigned as vice-president and general manager of the Flint Motor Co., of Flint, Mich. His successor is Wallace R. Willett, president of Durant Motors, Inc., of Indiana, and manager of that corporation's Muncie, Ind., plant.

IRVING F. GOODFRIEND has become associated with the De La Vergne Machine Co., of New York, as assistant in the engineering department.

W. T. ABERCROMBIE, JR., has joined the engineering staff of the U. S. Cast Iron Pipe and Foundry Company.

M. K. EPSTEIN has been appointed district manager at the New York office, for the Gilbert & Barker Manufacturing Co., of Springfield, Mass. Mr. Epstein was formerly owner of the Heat Treating Equipment and Supply Co., of Hartford.

CHARLES N. BOWNE, for the past ten years associated with Wm. Sellers & Co., machine tool builders of Philadelphia, has joined the engineering forces of the Ames Iron Works, Oswego, N. Y.

H. H. BOATRIGHT, formerly manager of the Indianapolis branch of the Timken Roller Bearing Sales and Service Co., has been transferred to the St. Louis office.

BENJAMIN NIELDS, JR., New York sales representative for the National Malleable and Steel Castings Co., has removed his offices from 30 Church St. to 17 East Forty-second Street.

JOHN P. MCLAREN, formerly of the Brown, McLaren Co., of Detroit, Mich., has organized the McLaren Screw Products Co., with headquarters in Detroit.

EARL R. FROST has been re-elected president and general manager of the National Machinery Co., of Tiffin, Ohio. Mrs. Augusta Rohn was elected vice-president; Henry J. Weller, secretary; Joseph P. Bork, assistant secretary; and William L. Hertzer, treasurer.

HARRY T. ADAMS, formerly of the Adams Axle Co., Syracuse, N. Y., has been appointed assistant to Russell E. Benner, factory manager of the Noiseless-Remington Typewriter Co.'s plant at Middletown, Conn. Mr. Adams was at one time connected with the Durant Motors Co., as an assistant manager and later was in charge of the plant of the Adams Axle Company.

T. G. MEACHEM has been elected vice-president of the Greasalt Products Corporation, of New York, and will have charge of the Syracuse office of the company, with headquarters in the Seitz Building. Mr. Meachem was formerly associated with the Meachem Gear Corporation.

E. B. BUSBY, with offices at 2315 Dime Bank Building, Detroit, Mich., is now sales representative for the Blood-Brothers Machine Co., manufacturer of universal joints and propeller shafts.

Obituaries

HARRY SYLVANUS HUNTER, aged 56, of East End, Pittsburgh, president of the Hunter Saw and Machine Co., died May 7 at Cambridge Springs, Pa. Mr. Hunter was born in Butler County and came to Pittsburgh in 1886, becoming associated with the old U. Baird Machine Co. and later the Pittsburgh district manager of the Chicago Pneumatic Tool Co., in 1897. He was a pioneer in the pneumatic tool industry.

In 1898 he founded the Hunter, Anschautz & Kennedy Co., which later became the Hunter Saw and Machine Co., of which he was president at the time of his death. He also was president of the Cowels Tool Co., of Cleveland, Ohio, and a director of the Allegheny Valley Bank of Pittsburgh.

He was a member of the Engineers' Society of Western Pennsylvania and the Society for Steel Treating.

DR. CHARLES W. BURROWS, one of the leading American authorities on the magnetic testing of steel, died on May 7. He was at one time a member of the technical staff of the Bureau of Standards having charge of the magnetic section. Among his contributions to the engineering world are the magnetic permeameter, the magnetic defectoscope, the magnetic analyzer and other like apparatus. He was a member of the American Institute of Electrical Engineers, Society of Automotive Engineers, American Society of Mechanical Engineers, American Society for Testing Materials and the American Society for Steel Treating, as well as the Engineers Club of New York.

WHEATON BRADISH BYERS, president of the New England Metallurgical Corporation and treasurer of the A. E. Hunt Steel Co., both of Boston, died recently at his home 49 Grove St., in that city. Mr. Byers was born in Newton Center, Mass., about 32 years ago, and graduated from Harvard college with the class of 1915. During the war Mr. Byers was a captain in the Ordnance Department. He was a member of the Harvard Club in both Boston and New York.

PAUL H. CAIN, head of the reclamation department of the Michigan Central Railway shops at St. Thomas, Ontario, died recently after a short illness.

Trade Catalogs

Belt Conveyors. The Hydraulic Pressed Steel Co., Cleveland, Ohio. The latest catalog issued by this company is devoted to Mellin Patented Belt Conveyor Idlers. It is bound in loose-leaf arrangement in heavy paper covers, and contains a wealth of data on the design, construction and utility of this equipment. Several types of idlers are illustrated and other pages contain photographs of shops or outside conveyors in which Mellin equipment is used. Another section of the catalog contains reproductions of blueprints with complete specifications for the types shown.

Ball Bearings. Standard Steel and Bearings, Inc., of Plainville, Conn., have issued a set of new SRB data sheets containing shaft and housing bore limits, equivalent tables and other special information helpful in properly applying ball bearings to various types of equipment. These sheets are in addition to the regular information previously issued by this company.

Ledrite Rod-O-Graph. Bridgeport Brass Co., Bridgeport, Conn. Some months ago this company issued a Rod-O-Graph in the form of a chart, providing a convenient way to figure the weight of brass rod required to make one thousand screw machine parts to known dimensions. A second edition of these charts has just been printed and is ready for distribution to those who make request of the company.

Hanna Bull Riveters. Hanna Engineering Works, Chicago, Ill., Bulletin No. R-204 illustrating and describing the latest models in Hanna bull riveters. The catalog shows all the newer types that have been improved to meet modern conditions. Sizes range from four inches to 21 ft. and capacities from six to 150 tons.

Steel Equipment. Angle Steel Stool Co., Plainwell, Mich. The new spring catalog of this company has just been issued. It contains seventy-two pages of information and data on the various steel products manufactured by this company—including stools, chairs, trucks, tables, factory and office steel equipment. Full particulars, with illustrations and specifications, are given for each type mentioned. A separate insert in this catalog is the new price list No. 100, just revised and effective in May.

Webster Systems of Steam Heating. Warren Webster & Co., Camden, N. J. A folder attractively made up to show the various regular and special types of heating apparatus made by this company. The greater part of the folder is given to pictures of the apparatus with brief descriptions.

Pax-Tite. The Watson-Stillman Co., 50 Church St., New York City. Bulletin No. A1-ED. 2, containing all the latest information on Pax-Tite leather packings as manufactured by this company. Packings for cups, flanges, U-packings and various other uses of this product are shown. Full details of size and price are also included.

Calendar of Local Meetings

American Society of Mechanical Engineers

Buffalo, N. Y. May 26. Annual meeting of section.

Portland, Ore., June 22 to 25. Pacific Coast Regional Meeting.

Society of Automotive Engineers

American Society for Steel Treating

Schenectady, N. Y. Spring Section Meeting. May 28, 29 and 30. Hotel Van Curler. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Cost Accountants

Milwaukee Chapter. June 9. Annual banquet.

Philadelphia Chapter. June 12. Subject: "Advertising Budget." How it is lined up and operated. Who pays for it?

Twin Cities. June 11. "Cost of Government." Annual election of officers.

Western Massachusetts. June 23.

Worcester. June 11. "Applied Economics."

Detroit Chapter. May 21. "Experience in Simplifying the Cost System."

Forthcoming Meetings

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

United States Chamber of Commerce. Thirteenth annual meeting, Washington, D. C., May 20, 21 and 22.

American Iron & Steel Institute. The 27th general meeting of American Iron & Steel Institute will be held May 22 at Hotel Commodore, New York.

National Association of Cost Accountants. Sixth international cost conference, Detroit, Mich., June 15, 16, 17 and 18. Headquarters at Hotel Statler. Secretary, Stuart C. McLeod, 130 West 42nd Street, New York City.

Division V of the American Railway Association. Business meeting June 16 to 18, Chicago. V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., in August. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron is in slightly better demand than a week ago; buying confined to small lots for immediate consumption; prices remain unchanged. Bars are the most active item on the steel list, with sales mostly at $2 per 100 lb., Pittsburgh. Price weakness is greatest in black steel sheets. Plates down 10c. per 100 lb., in week, to $1.90 at mill. Shapes bring $2 but with these and bars, quotations of $2.10 per 100 lb. apply on small tonnages.

Non-Ferrous Materials—Non-ferrous metals are apparently not suffering from the slowness of demand that characterizes iron and steel. Antimony rose 2c. per lb. in New York warehouses during the week. Copper is up ¼c.; lead ¼c. and tin ⅛c. per lb. from the market levels of May 8; zinc has not changed much since then. Linseed and machine oil are both 2c. per gal. higher than a week ago; lard cutting oil is down 5c.

(All prices as of May 15)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.27
Southern Ohio No. 2	23.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.26
Virginia No. 2	29.17
Basic	23.26
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50@2.70	3.89	3.35	3.80
No. 12	2.55@2.75	3.94	3.40	3.85
No. 14	2.60@2.80	3.99	3.45	3.95
No. 16	2.70@2.90	4.09	3.55	4.15
Black				
Nos. 17 to 21	3.05@3.30	4.15	4.05	4.30
Nos. 22 to 24	3.10@3.35	4.20	4.10	4.35
Nos. 25 and 26	3.15@3.40	4.25	4.15	4.40
No. 28	3.25@3.50	4.35	4.25	4.50
Galvanized				
Nos. 10 and 11	3.35@3.60	4.35	....	4.50
Nos. 12 to 14	3.45@3.70	4.45	....	4.60
No. 16	3.60@3.85	4.60	....	....
Nos. 17 to 21	3.75@4.00	4.75	....	4.90
Nos. 22 to 24	3.90@4.15	4.90	4.90	5.05
No. 26	4.05@4.30	5.05	5.05	5.20
No. 28	4.35@4.60	5.35	5.35	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; ⅛, 7½c.; ¼, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.12½
Tin, 5-ton lots, New York			55.25
Lead (up to carlots), St. Louis	7.65	New York	8.37½
Zinc (up to carlots), St. Louis	6.90	New York	7.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	16.00	14.00
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	21.25	20.00
Copper bars, base	20.87½	21.50	22.50
Copper tubing, base	23.75	24.25	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.00	11.25	11.37
Solder (½ and ½), (case lots)	39.50	36.50	....
Babbitt metal (83% tin)	60.00	65.00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	....	....
Nickel (electrolytic) f.o.b. refinery	38.00	....	....
Nickel (shot) f.o.b. refinery	32.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel Metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	10.25
Copper, heavy, and wire	10.75@11.00	11.00	10.25
Copper, light, and bottoms	9.25@9.75	9.00	9.00
Heavy lead	6.25@6.50	6.25	6.50@6.75
Tea lead	5.25@5.50	3.75	5.50@5.75
Brass, heavy, yellow	6.75@7.25	6.50	7.00
Brass, heavy, red	8.50@8.75	8.75	8.00
Brass, light	5.75@6.00	5.50	6.00
No. 1 yellow rod turnings	7.25@7.50	7.00	7.75
Zinc	4.00@4.25	3.75	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.75	$11.45	$11.00
"A" Grade:				
IC,	14x20	9.50	9.40	8.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14
Cotton waste, colored, per lb.	.10@.15½	.18	.09½
Wiping cloths, 13¼x13¼, per lb	.17	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.60	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.09	1.21	1.26
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0349
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb.	.1587½	.1587½	.15
Solder (½ and ½)	per lb.	.39½	.36	.37
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.60	.55
Machine oil	per gal.	.35	.33	.29
Belting, leather, medium	off list	30–10%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$5.00
Emery paper	10.71	11.00	11.00
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.50
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag		.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Attalla—Walworth Mfg. Co., 142 High St., Boston, Mass. (steam fitters supplies)—equipment for recently acquired plant, here.

Calif., San Andreas—Calaveras Cement Co., 900 California Commercial Bldg., San Francisco—2 traveling cranes, conveyors, etc.

Mass., Dorchester (Boston P. O.)—H. Rittenberg, 9 Magnolia St.—miscellaneous tools and equipment for repair and service garage.

Mass., East Boston (Boston P. O.)—J. McCulphia, 515-517 Bennington St.—miscellaneous tools and equipment for repair and service garage.

Mass., East Boston (Boston P. O.)—C. M. F. McLaughlin, 798 East Third St.—miscellaneous tools and equipment for repair garage.

Mass., Randolf — School Committee — manual training equipment, including wood working machinery, for Stetson High School.

Mass., Roxbury (Boston P. O.) — F. Bleiler, 15 Mansur St.—equipment and tools for repair and service garage.

Mass., South Lincoln — E. F. Trudo—2 woodworking planers and mortise machine and belts.

Mich., Detroit—Detroit Railway & Harbor Terminals Co., Buhl Bldg.—complete mechanical equipment, for handling rail and water shipments.

Mich., Pontiac—Wilson Foundry & Machine Co., South Saginaw and Wilson Sts.—equipment and conveyors for assembly plant.

Miss., Doddsville—T. C. Blanchard—15 in. shaper; power hack saw; and portable boring bar, suitable to bore 15 in. to 16 in. cylinders.

Mo., Mount Pleasant—W. E. Davis—handpower punch and shear, combination for structural shapes, to punch ¾ in. through ¾ in.

Mo., North Kansas City—Standard Steel Works—double geared double crank press or capacity, stroke and die space equal to Bliss No. 10-62 or larger.

O., Columbus — Jackson Pike Sand & Gravel Co., Jackson Pike and Frank Road, L. W. Innis, Gen. Mgr. (retail building supplies) — heavy loading and unloading machinery for new supply yard.

O., Spencerville—Bd. of Educ. of Shawnee Township, Allen Co., C. A. Argenbright, Supt. — complete equipment for manual training department in new high school, here.

Pa., Pittsburgh—Pittsburgh Coal Washer Co., Fulton Bldg.—75 ton jib crane.

Wis., Racine—Lakeside Malleable Casting Co., 23rd and Clark Sts., H. M. Osborne, Secy.—traveling crane and equipment for foundry and machine shop.

Opportunities for Future Business

Ala., Anniston—M & H Valve and Fitting Co., recently incorporated, capital $175,000, plans the construction of a plant, here, for the manufacture of valves and pipe fittings. J. W. Conway, Atlanta, Ga., Pres.

Ala., Attalla—Walworth Mfg. Co., 142 High St., Boston, Mass., has purchased the plant of the National Pipe & Foundry Co., here, and plans the construction of additional buildings. Estimated cost, with equipment $750,000.

Calif., Los Angeles—Davenport Mfg. & Implement Co., 1032 East First St., will build a group of buildings, including setting-up buildings, steel plant, foundry, woodworking shop, etc., at Atlantic and Manchester Aves. Private plans.

Calif., Los Angeles—Western Auto Supply Co., 517 East 7th St., awarded contract for the construction of a 5 story repair shop and garage. Estimated cost $55,000.

Calif., San Francisco—H. M. Schelk, 574 Bryant St., has had plans prepared for the construction of a 1 story machine shop at Stillman St. near 4th St. Estimated cost $8,000. Structural Engineering Co., Pacific Bldg., Engr.

Calif., Van Nuys—Robert-Morton Organ Co., H. P. Platt, Mgr., will soon award contract for the construction of a 100 x 100 ft. factory at Van Nuys St. Estimated cost $200,000. W. A. Schiller, 5076 Congress St., Berkeley, is architect. Noted May 14.

Fla., Brandentown—Hydraulic Concrete Building Materials Machine Co., 601 Brevard Ave., Tampa, plans the construction of a plant for the manufacture of machinery to make building stones, here.

Fla., Miami — Drake Lumber Co., L. Hector, Gen. Mgr., 327 6th St., awarded contract for the construction of a 420 x 130 ft. lumber mill. Estimated cost $40,000. Will build novelty mill for mouldings, frames, trimmings, etc., later.

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BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Ill., Chicago—Beardsly & Piper Co., 2541 North Keeler Ave., plans the construction of a 2 story, 290 x 300 ft. plant for the manufacture of foundry equipment at 2541 North Healy St. Estimated cost $100,000.

Ill., Chicago—Galand Upholstering Co., 1244 North Clark St., is having plans prepared for the construction of a 3 story, 50 x 125 ft. factory at 226 Schiller St. Estimated cost $60,000. Halperin & Braun, 19 La Salle St., Archts.

Ia., Davenport — Blackhawk Foundry & Machine Co. will build a 48 x 74 ft. iron foundry to be used as moulding room, at plant here.

Ia., Newton—Maytag Co. is having preliminary plans prepared for the construction of a 6 story, 84 x 213 ft., addition to washing machine factory. H. Raeder, 20 West Jackson St., Chicago, Ill., Archt.

Mass., Boston—S. Lebowich, 27 School St., plans to remodel and construct motor mart, into store and extensive ramp type garage, on Park Sq. bounded by Eliot St., Columbus Ave. Stuart St. and Broadway. Architect not selected.

Mass., Boston—The S. S. Pierce Co., 25 Jersey St., awarded contract for the construction of a 2 story, 90 x 130 ft. garage and repair shop, to M. C. Tuttle Co., 862 Park Square Bldg.

Mass., Boston—Y. D. Service Garage, c/o L. S. Joslin Archt., 339 Newbury St., is taking bids for the construction of a 3 story, 55 x 115 ft., repair and service garage, at 345-347 Newbury St. Estimated cost $100,000. Noted Apr. 23.

Mich., Pontiac—Wilson Foundry & Machine Co., South Saginaw and Wilson Sts., awarded contract for the construction of a 3 story, 100 x 400 ft. motor assembly plant, and 60 x 200 ft. motor test building. Estimated cost $1,000,000.

Mo., Kansas City — Interurban Central Station Co., c/o W. C. Scarritt, Scarritt Bldg., Secy., plans the construction of a 5 story, 120 x 258 ft. garage. Estimated cost $400,000. Architect not selected.

Mo., Kansas City — Schutte Investment Co., 3015 Southwest Blvd., is having plans prepared for the construction of a 3 story garage and sales room. Estimated cost $175,000. R. H. Sanneman, 519 Lee Blvd., Archt.

Mo., St. Louis — Multiplex Faucet Co., 2126 Cass Ave., awarded contract for the construction of a 2 story, 80 x 160 ft. faucet factory on Duncan Ave. Estimated cost $75,000. Noted May 14.

O., Barberton—Ohio Insulator Co. plans the construction of a factory addition. Estimated cost $30,000.

O., Cleveland—Sabin Machine Co., H. B. Sabin, Pres., 6536 Carnegie Ave., awarded contract for the construction of a 3 story, 45 x 90 ft. factory addition at plant. Estimated cost $50,000. Private plans. Noted Apr. 23.

Pa., Landsdowne—A. R. Knight will soon award contract for the construction of a 67 x 119 ft. sales and service building at Baltimore and Wycomb Aves. E. A. Stopper, 10 South 18th St., Philadelphia, Archt.

Pa., Philadelphia—Philadelphia Storage Battery, Ontario Ave., and C St., awarded contract for the construction of a 40 x 100 ft. workshop, at plant.

Pa., Scranton—P. J. Casey, Hotel Casey, awarded contract for the construction of a 4 story, 120 x 160 ft. garage, on Lackawanna Ave. Estimated cost $350,000. Noted Apr. 23.

Vt., Manchester Depot—N. D. Cass Co., 62 Canal St., Athol, Mass., plans the construction of a plant, here, to replace fire loss. Estimated cost $125,000. Architect not selected.

Vt., Springfield—The Fellows Gear Shaper Co., E. R. Fellows, Pres., is having plans prepared for the construction of a 2 story, 30 x 60 ft. pattern storage house.

Wash., Vancouver — Vancouver Lumber Co., E. J. Young, 1 West Main St., Madison, Wis., plans the construction of new buildings, wharves, etc., here. Estimated cost $1,000,000.

Wis., Park Falls—Park Falls Lumber Co., Bd. of Directors will not rebuild saw mill recently destroyed by fire. Noted May 7.

Wis., Racine—Lakeside Malleable Casting Co., 23rd and Clark Sts., plans the construction of a 80 x 300 ft. foundry building at 23rd St. Architect and engineer not selected.

Wis., West Allis—Marks Bros. Co., 7501 Summit Ave., (Millwork) awarded contract for the construction of a 2 story factory addition at Summit Ave. Estimated cost $25,000.

Wis., Wisconsin Rapids—Bd. of Educ., W. A. Sprise, Dir., plans the construction of a 32 x 60 ft. machine shop here. Architect not selected.

B. C., False Creek—Robertson & Hackett Co. plans the construction of a lumber mill to replace fire loss. Estimated cost $300,000.

Que., Thurso—The Singer Mfg. Co., Ottawa, Ont., is receiving bids for the construction of 2 mills. Noted Feb. 26.